Lorain® Model A150CAB Rectifier Mounting Shelf

Spec. No.588244600
E/W Spec No. 486526401

Technical Documentation

Power Products

RELTEC®

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LORAIN® MODEL A150CAB

RECTIFIER MOUNTING SHELF

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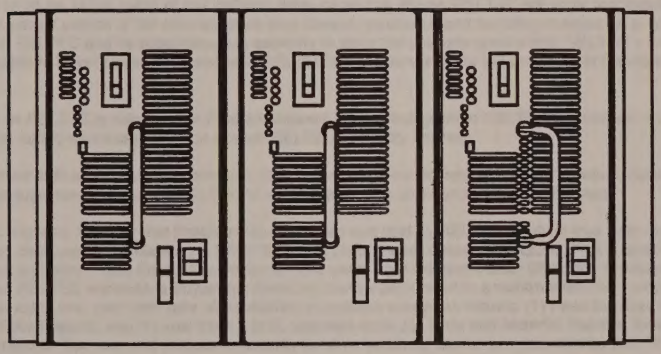

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21. Severability. Should any provision of these terms and conditions be declared by any court of competent jurisdiction to be invalid or unenforceable, the remaining provisions shall not be affected thereby, it being the intent of the parties that they would have executed the remaining portion without including any such part or portion which may for reason be declared invalid.

22. Governing Law. This Agreement shall be governed by and construed in accordance with the laws of the State of Ohio (excluding its conflict of laws provisions), including the provisions of the UCC in the State of Ohio. Any proceeding pertaining to any such claim shall be venued in Cleveland, Ohio.

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25. Headings. Captions or headings are inserted only for convenience and shall not be construed as part of the foregoing terms and conditions or as a limitation upon the scope of the particular section to which they refer.

Section 2992 December 9, 1998

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122 Edward St. / St. Thomas, Ontario N5P 1Z2 / (519) 631-0780
In Mexico:
Productos RELTEC de Mexico S.A. de C.V.
Apartado Postal 77001 / Mexico 10 D.F., MX 11200 / (525) 576-8277

LORAIN® MODEL A150CAB
FLOTROL® RECTIFIER CABINET
SPEC. NO. 588244600
EQUIPPED WITH
SPEC. NO. 486526401 RECTIFIER MODULES

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RECTIFIER MAINTENANCE SCHEDULE

APPENDIX

1. DESCRIPTION

General

1.01 This FLOTROL® Modular Rectifier System consists of an equipment shelf which can accomodate up to three separately ordered rectifier plug-in modules. One, two or three 50 ampere rectifier modules (Spec. No. 486526401) and the equipment shelf comprise a charging system which operates from nominal 208/240 volt AC to provide filtered and regulated 48 volts DC to maintain a battery in a fully charged condition while powering a load. The rectifier modules are designed with high frequency power conversion circuits to minimize space and weight requirements. The rectifier system is finished in equipment light gray.

1.02 Float Charging: Rectifier output current remains equal to load current as long as load current does not exceed a predetermined (adjustable) value. This mode of operation is known as float charging. During normal operation, the battery does not furnish load current and remains in a fully charged condition.

1.03 Equalize Charging: When using this rectifier to charge a conventional flooded cell battery, if higher DC voltage is required for equalizing the charge on all battery cells or for recharging the battery following a commercial power failure, the rectifier may be placed in the equalize mode of operation. The equalize mode can be selected from a remote location such as the control panel of an associated power board. No local control is provided.

1.04 Current Limiting: When an AC power failure results in battery discharge or in the event of DC overload, an output current limiting circuit prevents the increase of output current above a predetermined value.

1.05 Paralleling: This rectifier system can be connected in parallel with other Model A150CAB rectifier shelves adjusted to the same output voltage. The rectifier modules have an internal circuit to enhance load sharing.

1.06 High Voltage Shutdown

a) Internally Selective: If rectifier module output voltage exceeds an adjustable preset value, the module will shut down. After approximately 3 seconds, the module will automatically restart. If the rectifier module output voltage again exceeds the high voltage shutdown value within 5 minutes, the module will shut down and lock out. If the rectifier does not experience a high voltage condition within the 5 minute time period, the restart circuit is reset.

   If two or more rectifier modules are present in the shelf, or if the shelf is paralleled with other rectifiers, only the rectifier module causing the high voltage condition shuts down. This is accomplished by increasing the preset high voltage shutdown point by 2 to 3 volts when the rectifier module is delivering less than 3 amperes of current. If one rectifier module experiences a high voltage condition, it is assumed that this rectifier module will provide the load and that the others will deliver less than 3 amperes of current. This will cause their high voltage shutdown point to shift 2 to 3 volts higher than that of the faulty rectifier module. The faulty rectifier module shuts down. The other rectifier modules pick up the load and their high voltage shutdown point is returned to normal.

   The high voltage shutdown range and setpoint are automatically increased by 2 to 3 volts when the rectifier module is placed in the equalize charge mode. This is in addition to the 2 to 3 volts increase if the rectifier is delivering less than 3 amperes of current as described above.

b) Back-Up: If rectifier module output voltage exceeds a second preset (non-adjustable) value, the input circuit breaker trips open, shutting down the module. The AC INPUT circuit breaker must be manually reset to restart the rectifier module.

c) Remote High Voltage Shutdown: The rectifier modules can be shut down from a remote location. Application of ground (+BAT) activates the selective high voltage shutdown circuit of each module. The ground (+BAT) signal must be removed within 200 milliseconds. Due to the selective nature of the shutdown circuit, only rectifier modules delivering 3 amperes or more of current shut down.

1.07 External Voltage Sensing: External voltage sensing leads must be extended from the rectifier shelf to the battery or load terminals at which DC regulation is required. If the sense leads are not connected, local and remote alarms are activated and the rectifiers transfer to internal voltage sensing.

1.08 Low Input Voltage Inhibit: If the AC input voltage decreases below a preset value, the rectifier module power conversion circuitry inhibits, disabling module output. When AC input voltage increases to another preset value, the rectifier module will automatically restart.

1.09 High Rectifier Module Internal Temperature Inhibit: If the internal temperature of the rectifier module exceeds a preset value, the rectifier module power conversion circuitry is inhibited. When temperature decreases to a safe level, the rectifier module will automatically restart.

1.10 Metering: The load that the rectifier module is supplying is indicated by illuminated light emitting diodes. There are ten LEDs, each representing 5 amperes of current when lit. Each segment will be fully lit at its designated current, ± 2 amperes.

1.11 Meter Test Points: Insulated test points are provided as a convenient method of connection of an external high impedance DC voltmeter to monitor rectifier output current (1 millivolt = 1 ampere), and the voltage at the point of regulation.

1.12 Rectifier Self Test Features: A circuit monitors power transformer primary current. If for any reason primary current is absent, a test signal is activated. If the power conversion circuitry does not respond to the test signal, the Rectifier Fail Alarm is activated.

NOTE

Shutting down the rectifier with a Remote On/Off (TR) signal will inhibit the rectifier fail alarm. (See Paragraph 1.18.)

1.13 Rectifier Fail Alarm: If any condition listed below occurs which disables the output of any rectifier module in the shelf, local and remote alarms are activated.

a) Complete failure of AC input voltage, or decrease of AC input voltage below a predetermined level.

b) AC input circuit breaker switched off, either manually or automatically. The AC input circuit breaker automatically trips open during an input overcurrent condition, a back-up high voltage shutdown condition, when the emergency shutdown circuit is activated, when input bank voltage exceeds a predetermined value, or when the DC output circuit breaker is opened.

c) Rectifier output voltage exceeds the high voltage shutdown setting.

d) Internal temperature of module exceeds a preset value which inhibits the power conversion circuit.

e) Any failure condition that disables rectifier output.

1.14 Fan Fail Alarm: Each rectifier module is equipped with one cooling fan. If the fan fails, local and remote alarms are activated. A separate fan fail alarm terminal is provided for each rectifier module.

1.15 Open Sense Lead / Open Output Circuit Breaker Alarm: If an external sense lead opens or the DC OUTPUT circuit breaker of the rectifier module opens either manually or automatically, local and remote alarms are activated. In addition, the rectifier automatically transfers to internal voltage sense.

1.16 Shunt Output: A signal that is proportional (1 millivolt = 1 ampere) to output current (shunt output) is available from each rectifier module.

1.17 Remote Equalize: All rectifier modules are placed into the equalize charge mode by application of a ground (+BAT) signal. The rectifier modules are placed into float charge mode when the ground (+BAT) signal is removed. (No local control is provided.)

1.18 Remote On/Off (TR): A rectifier module can be inhibited by application of a ground (+BAT) signal. Rectifier module is restarted when the ground (+BAT) signal is removed. No rectifier fail alarm is given when rectifier is shut down in this manner. A separate remote on/off (TR) terminal is provided for each rectifier module (except when accessory terminal block is used).

1.19 Emergency Shutdown: The input circuit breakers of all rectifier modules in the shelf can be tripped open from a remote location by application of a ground (+BAT) signal. Rectifiers must then be manually restarted.

1.20 Output Current Walk-In: Output current gradually increases after the rectifier is switched on.

1.21 Rectifier Module Test Switch: A momentary three position test switch (RECT TEST) is provided on each rectifier module. This switch allows the output voltage of the module to be momentarily increased or decreased by one volt for module testing purposes.

2. TEST APPARATUS

2.01 The following list of tools and test equipment is sufficient to perform any test or adjustment procedure detailed in this instruction manual.

Test Equipment	Description
Digital Multimeter	Fluke Model 8022A or equivalent
Insulated Screwdriver	GC Electronics type 8728A or equivalent
Adjustable Resisitve Test Load	Capable of 55 amperes, adjustable to 1 ampere

3. INSTALLATION

Physical Considerations

3.01 Mounting: The rectifier shelf is designed for mounting in a 23 inch wide relay rack with 1 or 1-3/4 inch multiple drilling, and requires 12-3/16 inches of vertical rack space. Also, the distance from the rear of the rectifier cabinet to a wall or other solid structure must not be less than the following limits.

a) Four (4) inches when the rectifier is operated in a +50°C (+122°F) ambient.

b) Six (6) inches when the rectifier is operated in a +65°C (+149°F) ambient.

NOTE

Remove the plastic shield over the DC output busbars before mounting the rectifier shelf to the relay rack.

3.02 Ventilation Requirements: This Modular Rectifier System must be mounted so front and rear ventilation openings are not blocked and the temperature of air entering the shelf does not exceed the operating ambient temperature limits specified in the Power Data (PD) Sheet.

Installation of Accessory Alarm and Control Wiring Terminal Block Assembly (if provided)

3.03 General: The Accessory Alarm and Control Wiring Terminal Block Assembly interfaces the existing J8 connector to the supplied screw-type terminal block (TB2). This accessory is mounted on the right side of the cabinet, next to connectors J7 and J8. To install and wire the accessory, follow the procedure described below. As the procedure is performed, refer to Figure 3-1.

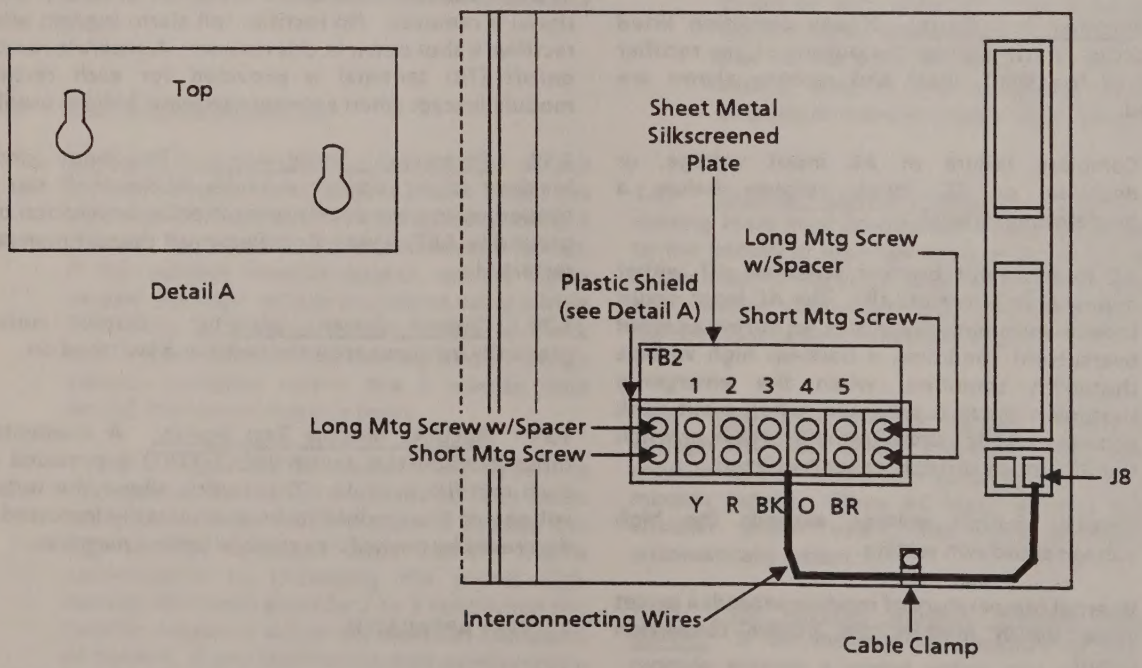


Figure 3-1
Accessory Alarm and Control Wiring Terminal Block Installation

NOTE

This accessory must be installed after the cabinet is mounted in the relay rack.

a) Locate the components of the accessory. These are packaged together in one plastic bag and includes:

   1) a plug-in connector (with wires pre-attached) that mates with connector J8 located on the cabinet

   2) a cable clamp

   3) a five position terminal block

   4) a plastic shield

   5) a sheet metal silkscreened plate

   6) four self-threading 6-32 screws, two 1" in length and two 1/2" in length.

   7) two metal spacers

b) Locate the four predrilled holes for mounting the terminal block to the cabinet's right side panel (near J7 and J8).

c) Place the sheet metal silkscreened plate under the terminal block, then mount both to the cabinet's side panel using the two shorter screws as shown in Figure 3-1. Insure that the silkscreening is visible.

d) Place a metal spacer on each of the remaining two screws. Place the two screws with spacers in the remaining terminal block mounting holes. Partially tighten the screws.

e) Plug the supplied connector into J8.

f) Attach the wires from the plug-in connector to the lower screws of the terminal block (TB2) as described below.

   1) Attach the yellow wire to terminal 1 of TB2.

   2) Attach the red wire to terminal 2 of TB2.

   3) Attach the black wire to terminal 3 of TB2.

   4) Attach the orange wire to terminal 4 of TB2.

   5) Attach the brown wire to terminal 5 of TB2.

g) Bundle the five wires connected between J8 and TB2 together near the bottom of the cabinet. Secure these to the cabinet using the supplied cable clamp. Use one of the existing screws in the bottom of the cabinet's side panel to secure the cable clamp to the cabinet.

h) Attach the plastic shield over the terminal block (TB2) after the alarm and control connections (described later) are made. Do this by backing out the two screws with the metal spacers, and then sliding the keyholes in the plastic shield over the screws. Tighten the screws.

Initial Electrical Connections

3.04 Wiring: Refer to the Power Data (PD) sheet for general wiring and fusing recommendations and installer's information. All wiring and branch circuit protection should follow provisions of the current edition of the National Electrical Code. Referenced to the 1990 edition for specific requirements are:

Article 240-6 Branch Circuit Rating

Table 310-16 (75°C) Ampacity of Power Conductors

Table 250-95 Grounding Conductors

DANGER

This rectifier operates from a power source capable of producing severe, perhaps fatal, electrical shock. AC input power must be completely disconnected from the the branch circuit wiring used to provide power to the rectifier before any electrical connections are made.

3.05 General: AC input and frame ground connections are made from the front of the shelf. To gain access to these terminals, remove the rectifier module or blank cover panel from the far left module mounting position of the shelf. DC output and alarm and control connections are made at the exterior of the shelf right side panel. DC output connections will be made after initial rectifier adjustments are performed.

Refer to the Power Data sheet for further information as the following electrical connections are made.

3.06 Input Connections: Make AC input connections to terminal block TB1, which is located inside the rectifier shelf at the lower left-hand side of the rear panel. AC wiring is fed into the shelf through a rectangular opening at the rear of the left side panel. Separate input connections are provided for each rectifier module in the shelf, as shown in the INSTALLER'S CONNECTIONS in the Power Data sheet. Make input connections to all module positions at this time, including the currently unused positions.

NOTE

An AC input housing kit is available as an accessory. refer to the Power Data sheet for a description. and the instructions supplied with the kit for installation details.

3.07 Frame Ground Connection: A FR GND (frame ground) lug, located inside the rectifier shelf at the left-hand side of the rear panel must be connected to earth ground. Do not connect this terminal to power system neutral. The frame ground wire is fed into the shelf through a rectangular opening at the rear of the left side panel.

Alarm and Control Connections

3.08 General: Alarm and control connections are made either to a 15-pin plug-in connector (J7) and a 12-pin plug-in connector (J8), or; if the accessory alarm and control wiring terminal block assembly is installed, to a screw-type terminal block (TB2). The connectors are located at the lower rear of the rectifier shelf right side panel. Refer to the Power Data (PD) sheet for further information as the following alarm and control connections are made.

NOTE

If the accessory alarm and control wiring terminal block assembly is not used. the customer must supply the mating connector for J7 and J8. Refer to the following:

Mating Connector Part No. - AMP 172171-1 (P7). AMP 172170-1 (P8)

Mating Contact Part No. - AMP 170362-3

Hand Crimp Tool Required - AMP 724651-1

3.09 External Voltage Sensing: Pins 1 (+) and 2 (-) of J8 are provided as external voltage sensing terminals. If the accessory alarm and control terminal block is installed, external voltage sensing is provided at terminals 2 (SNS+) and 3 (SNS-) of TB2. Connect these terminals to the power system battery or other point at which DC regulation is required. Observe correct polarity. Extended sense leads should be fused at 1-1/3 amperes.

NOTE

Where more than one shelf is used in a power system. the voltage sensing leads from all shelves should be connected to the same point.

3.10 Rectifier Fail Alarm (resistive ground): During a failure condition in any rectifier module in the shelf, resistive ground or ground (+BAT) is supplied to J8 pin 12. Under normal conditions, resistive ground or ground is removed. The value of resistance varies depending on the number of failed modules, so that a compatible alarm and control panel can issue a minor or major alarm as required. A four position switch is provided on each rectifier module which allows selection of three separate groups of resistance values. This allows the rectifier shelf to be interfaced with a variety of alarm and control panels using impedance matching for identifying minor and major alarms. The fourth position of the switch enables the rectifier module to supply a ground (+BAT) signal (1 ampere at 30 VDC, 0.3 ampere at 110 VDC) when used without impedance matching alarm panels. Refer to Table 3-1 for resistance values of the three groups. Refer also to Paragraph 3.21 for an adjustment procedure, and appropriate switch settings for various LORAIN alarm and control panels. If the accessory alarm and control terminal block is installed, the RFA signal is available at pin 1 of TB2. Conditions which result in a Rectifier Fail Alarm are listed in Paragraph 1.13.

3.11 Rectifier Fail Alarm (resistive battery): During a failure condition in any rectifier module in the shelf, resistive battery (-BAT) is supplied to the respective alarm terminal of J7 as shown in Table 3-2. Under normal conditions, ground (+BAT) is supplied. Conditions which result in a Rectifier Fail Alarm are listed in Paragraph 1.13.

3.12 Shunt Output: A voltage which is proportional (1 millivolt = 1 ampere) to the output current (shunt output) of each rectifier module, is available at J7 as shown in Table 3-3.

No. of Failed Modules	Alarm Resistance Value (Ohms) Group 1	Alarm Resistance Value (Ohms) Group 2	Alarm Resistance Value (Ohms) Group 3
1	27.4K	41.2K	10K
2	13.7K	20.6K	5K
3	9.13K	13.73K	3.33K

Table 3-1
RFA Resistive Ground Values

Rectifier Module	J7 Pin
1	7
2	8
3	9

Table 3-2
Rectifier Fail Alarm Terminals

Rectifier Module	J7 Pin
1	1 (+) 4 (-)
2	2 (+) 5 (-)
3	3 (+) 6 (-)

Table 3-3

3.13 Fan Fail: If the internal fan of a rectifier module fails, ground (+BAT) is supplied to the respective alarm terminal of J7 as shown in Table 3-4.

3.14 Open Sense Lead / Open Output Circuit Breaker: If an external sense lead opens or the DC OUTPUT circuit breaker of a rectifier module opens either manually or automaticaly, ground (+BAT) is supplied to the respective alarm terminal of J7 as shown in Table 3-5.

Rectifier Module	J7 Pin
1	10
2	11
3	12

Table 3-4

Rectifier Module	J7 Pin
1	13
2	14
3	15

Table 3-5
Open Sense Lead / Open
Output Circuit Breaker
Alarm Terminals

3.15 Remote On/Off (TR): Customer furnished ground (+BAT) applied to the respective pin of J8, as shown in Table 3-6, disables the output of the respective rectifier module. Removal of the ground signal returns the module to normal operation.

NOTE

If the accessory alarm and control terminal block is installed. the remote on/off (TR) terminals of all rectifier modules are tied to pin 4 of TB2. Customer furnished ground (+BAT) applied to pin 4 of TB2 disables the output of all rectifier modules. Removal of the ground signal returns all modules to normal operation.

Rectifier Module	J8 Pin
1	3
2	4
3	5

Table 3-6
Remote On/Off (TR)
Control Terminals

3.16 Remote High Voltage Shutdown: Customer furnished ground (+BAT) applied to J8 pin 6 activates the selective high voltage shutdown circuit of all rectifier modules in the shelf. Refer to Paragraph 1.06 for a description of the selective high voltage shutdown circuit. Due to the selective nature of the shutdown circuit, only rectifier modules delivering 3 amperes or more of current shut down.

NOTE

The ground (+BAT) signal must be removed within 200 milliseconds.

3.17 Remote Equalize Control: Customer furnished ground (+BAT) applied to J8 pin 8 places all rectifier modules into the equalize mode of operation. Removal of ground (+BAT) from this terminal places all rectifier modules into float charge mode of operation. If the accessory alarm and control terminal block is installed, the remote equalize signal (EQ) is connected to pin 5 of TB2.

3.18 Emergency Shutdown: Customer-furnished ground (+BAT) applied to J8 pin 10 trips open the AC INPUT circuit breakers of all rectifier modules in the shelf.

3.19 At this time attach the plastic shield over terminal block TB2 as described in Paragraph 3.03 h).

Wiring Options

3.20 General: A four position switch (S1) is provided on each rectifier module which selects what type of signal is provided to J8 pin 12 (or TB2 pin 1) during a rectifier fail alarm condition; either one of three available resistive ground signals, or a ground (+BAT) signal. Switch S1 is located on circuit card A2 (486543100), and is accessed by removing the sheet metal panel from the left side of the rectifier module. Refer to Table 3-7, and adjust Switch S1 per the requirements of the specific installation. Adjust Switch S1 of each rectifier module installed in the shelf to the same setting. If this rectifier cabinet is used in a LORAIN Power System, Switch S1 on each rectifier module factory installed in the cabinet has been factory adjusted to the correct setting.

Resistance Values of Group (See Table 3-1)	Switch S1 Settings		Settings Compatible with LORAIN Alarm and Control Panel(s), Part No(s).
	Switch Position	Open/ Close	
1	1	Closed	437422100 437422800 437423000 437423100
	2	Open	
	3	Open	
	4	Open	
2	1	Open	437420600 437420700 437420800 437420900 437421600 437421900 437422300 437423300 437423400
	2	Closed	
	3	Open	
	4	Open	
3	1	Open	437417400
	2	Open	
	3	Closed	
	4	Open	
Ground (+BAT) Signal Provided	1	Open	--
	2	Open	
	3	Open	
	4	Closed	

Table 3-7
Switch S1 Settings

NOTE

The DC OUTPUT circuit breaker has a mechanical interlock which prevents a rectifier module from being plugged into or pulled out of a shelf with the DC OUTPUT circuit breaker left in the ON position.

Initial Startup and Checkout

3.21 General: Before making any connections to the DC output terminals, perform the following startup and checkout procedure to insure proper rectifier operation.

3.22 Initial Startup Preparation

a) Insure that the AC INPUT and DC OUTPUT circuit breakers on each rectifier module are placed to the OFF position.

NOTE

The DC OUTPUT circuit breaker has a mechanical interlock which prevents a rectifier module from being plugged into a shelf with the DC OUTPUT circuit breaker left in the ON position.

b) Install rectifier module(s) into the shelf. If present, first remove the blank cover panel(s) from the desired shelf positions. Install the modules and secure by tightening the captive fasteners on the front of each.

c) Check the control panel of the associated power board to insure that the rectifiers will be operating in the float mode. Refer to the power board instruction manual if necessary.

d) Insure that all initial installer's connections were performed in accordance with the Power Data (PD) sheet furnished with this manual. Refer also to Paragraphs 3.05 through 3.21 of these instructions for electrical connection details.

e) Insure that the external AC disconnect or protective device is adequately sized.

DANGER

The following procedures are performed with power applied to the rectifier. This rectifier operates from AC voltage capable of producing fatal electrical shock. AC input voltage may be present at the AC input terminals of the rectifier. Battery voltage may be present at the DC output terminals and extended reference leads. Servicing personnel must observe all safety precautions normally associated with maintenance and adjustment of electronic equipment, and must avoid direct contact with any energized electrical termination. This rectifier produces high DC output current; therefore, servicing personnel must remove watches, rings, or other jewelry before making test equipment connections or performing adjustments.

3.23 Rectifier Startup: Apply AC input power by closing the external AC disconnect or protective device. On each rectifier module, place first the AC INPUT circuit breaker to the ON position, then the DC OUTPUT circuit breaker to the ON position. If the AC INPUT circuit breaker immediately trips open, place it back to the ON position before operating the DC OUTPUT circuit breaker. The rectifier should start and the output voltage should be within the range of 48.0 to 58.0 volts.

3.24 Float Voltage Check: The float output voltage should be checked, and adjusted if necessary. Unless otherwise specified, the float voltage of each rectifier module has been factory adjusted to 54.48 VDC. If the type of battery to be used with the system is specified, the factory float setting is as shown in Table 3-8. To check the float voltage value, perform the following steps:

Adjustment	Factory Setting (Limited Maintenance Batteries)	Conventional Flooded Cells Battery Setpoints
Float Voltage	54.48 VDC	52.08 VDC
Equalize Voltage	56.00 VDC	54.00 VDC

Table 3-8

a) Operate the control panel of the associated power board as required to place the rectifier system into the float mode. Refer to the power board instruction manual if necessary. Allow the voltage to stabilize.

b) On each rectifier module, place first the AC INPUT circuit breaker to the OFF position, then the DC OUTPUT circuit breaker to the OFF position.

c) Connect a resistive test load, adjusted for approximately 25 amperes, to the rectifier shelf output terminals. The test load setting should be identical for all modules.

d) Connect a digital multimeter (DMM) set to indicate DC voltage to the RECT VOLT test points located on the front of the module under test. Observe correct polarity.

e) On the module under test, place first the AC INPUT circuit breaker to the ON position, then the DC OUTPUT circuit breaker to the ON position. If the AC INPUT circuit breaker immediately trips open, place it back to the ON position before operating the DC OUTPUT circuit breaker.

f) Verify that the float output voltage is as desired. If it is necessary to change the float output voltage, adjust potentiometer FLOAT clockwise to increase output voltage or counterclockwise to decrease output voltage. Make adjustments in small increments, and allow voltage to stabilize.

NOTE

If the rectifier module loses output voltage while adjusting the float voltage. adjust the HVSD potentiometer fully clockwise. Readjust the float voltage when the rectifier restarts. Refer to Paragraph 5.05 to adjust the high voltage shutdown point.

g) On the module under test, place first the AC INPUT circuit breaker to the OFF position, then the DC OUTPUT circuit breaker to the OFF position.

h) Repeat Steps d) through g) for each of the remaining modules in the shelf.

NOTE

To insure proportionate sharing of the load between all rectifier modules in the shelf. the float voltage setting should be identical for all modules.

i) When adjustment is completed, disconnect the test load (if no more checks are to be performed) and DMM test probes. This completes the float voltage check.

3.25 Equalize Voltage Check: The equalize output voltage should be checked, and adjusted if necessary. Unless otherwise specified, the equalize voltage of each rectifier module has been factory adjusted to 56.00 VDC. If the type of battery to be used with the system is specified, the factory equalize setting is as shown in Table 3-8. To check the equalize voltage value, perform the following steps:

a) Operate the control panel of the associated power board as required to place the rectifier system into the equalize mode. Refer to the power board instruction manual if necessary. Allow the voltage to stabilize.

b) On each rectifier module, place first the AC INPUT circuit breaker to the OFF position, then the DC OUTPUT circuit breaker to the OFF position.

c) Insure that a resistive test load, adjusted for approximately 25 amperes, is connected to the rectifier shelf output terminals. The test load setting should be identical for all modules.

d) Connect a digital multimeter (DMM) set to indicate DC voltage to the RECT VOLT test points located on the front of the module under test. Observe correct polarity.

e) On the module under test, place first the AC INPUT circuit breaker to the ON position, then the DC OUTPUT circuit breaker to the ON position. If the AC INPUT circuit breaker immediately trips open, place it back to the ON position before operating the DC OUTPUT circuit breaker.

f) Verify that the equalize output voltage is as desired. If it is necessary to change the equalize output voltage, adjust potentiometer EQ clockwise to increase equalize voltage or counterclockwise to decrease equalize voltage. Make adjustments in small increments, and allow voltage to stabilize.

g) On the module under test, place first the AC INPUT circuit breaker to the OFF position, then the DC OUTPUT circuit breaker to the OFF position.

h) Repeat Steps d) through g) for each of the remaining modules in the shelf.

NOTE

To insure proportionate sharing of the load between all rectifier modules in the shelf. the equalize voltage setting should be identical for all modules.

i) When adjustment is completed, disconnect the test load (if no more checks are to be performed) and DMM test probes. This completes the equalize voltage check.

3.26 Current Limit Check: The current limit point should be checked, and adjusted if necessary. Unless otherwise specified, each rectifier module is factory adjusted to limit current at 105% of full load. To check the current limit point, perform the following steps:

a) On each rectifier module, place first the AC INPUT circuit breaker to the OFF position, then the DC OUTPUT circuit breaker to the OFF position.

b) Insure that a resistive test load, adjusted for slightly more than the desired current limit point, is connected to the rectifier shelf output terminals.

c) Connect a digital multimeter (DMM) set to indicate DC voltage to the RECT CUR test points located on the front of the module under test. Observe correct polarity.

d) On the module under test, place first the AC INPUT circuit breaker to the ON position, then the DC OUTPUT circuit breaker to the ON position. If the AC INPUT circuit breaker immediately trips open, place it back to the ON position before operating the DC OUTPUT circuit breaker.

e) Multiply the reading on the multimeter (in millivolts) by 1 to obtain the output current (in amperes) of the rectifier module (eg. 1 millivolt=1 ampere). Verify that the rectifier module limits output current at the desired point. If it is necessary to change the current limit point, refer to Paragraph 5.04.

f) On the module under test, place first the AC INPUT circuit breaker to the OFF position, then the DC OUTPUT circuit breaker to the OFF position.

g) Repeat Steps c) through f) for each of the remaining modules in the shelf.

h) When adjustment is completed, disconnect the test load and DMM test probes. This completes the current limit check.

3.27 High Voltage Shutdown Check: The high voltage shutdown point should be checked, and adjusted if necessary. Unless otherwise specified, each rectifier module is factory adjusted for a high voltage shutdown point of 59.5 volts. To check the high voltage shutdown point, perform the following steps:

a) Check the control panel of the associated power board to insure that the rectifier system is in the float mode of operation. Refer to the power board instruction manual if necessary.

b) On each rectifier module, place first the AC INPUT circuit breaker to the OFF position, then the DC OUTPUT circuit breaker to the OFF position.

c) Connect a digital multimeter (DMM) set to indicate DC voltage to the RECT VOLT test points located on the front of the module under test. Observe correct polarity.

d) On the module under test, place the AC INPUT circuit breaker to the ON position. Immediately turn back ON the AC INPUT circuit breaker if it trips open.

e) Note the output voltage indicated on the DMM for later reference.

f) Note the output voltage indicated on the DMM while slowly adjusting potentiometer FLOAT clockwise. Continue adjusting potentiometer FLOAT until shutdown occurs, and note the shutdown voltage level. The module will automatically restart in approximately 3 seconds. Immediatly adjust potentiometer FLOAT counterclockwise approximately 1-turn (to prevent lock out).

NOTE

If after an initial high voltage shutdown, the rectifier module output again exceeds the high voltage shutdown value within 5 minutes, the module will shutdown and lockout. Refer to Paragraph 4.08 for a restart procedure.

g) Verify that the high voltage shutdown point is as desired. If it is necessary to change the high voltage shutdown point, refer to Paragraph 5.05.

h) When the desired shutdown level is attained, adjust potentiometer FLOAT for the output voltage value originally noted in Step e).

i) On the module under test, place the AC INPUT circuit breaker to the OFF position.

j) Repeat Steps c) through i) for each of the remaining modules in the shelf.

k) When adjustment is completed, disconnect the DMM test probes. This completes the high voltage shutdown check.

3.28 This completes the Initial Startup and Checkout procedure. Final electrical connections should now be made as described in the following paragraphs.

Final Electrical Connections

3.29 Output Connections: After completing the Initial Startup and Checkout procedure, connect the DC output leads to terminals - and +, observing correct polarity. The DC output terminals are located at the rear of the rectifier shelf right side panel. Unless otherwise specified, the shelf is shipped without output lugs. Drilled busbars are provided for connection of customer-furnished lugs. Four (4) 3/8-16 x 1 inch bolts, four (4) 3/8 inch flatwashers, and four (4) Belleville lockwashers are furnished for making the lug connections. The correct hardware order is: bolt, Belleville lockwasher, flatwasher, lug, busbar. Refer to the Power Data sheet for recommended lug and wire size information. Re-install the plastic shield over the DC output busbars after output leads are connected.

WARNING

Use only the specified hardware for making output lug connections. Use of bolts longer than specified may result in damage to the rectifier.

NOTE

A Belleville lockwasher is a conical spring steel washer, and must be installed so that its outer edge contacts the adjacent flatwasher, and its inner edge contacts the adjacent bolt head.

Final Checkout

3.30 After making DC output connections, restart the system as follows. On each rectifier module, place first the AC INPUT circuit breaker to the ON position, then the DC OUTPUT circuit breaker to the ON position. If the AC INPUT circuit breaker immediately trips open, place it back to the ON position before operating the DC OUTPUT circuit breaker. Check the RECT CUR indicator on each module to insure that the modules are sharing the load, and are operating at less than 100% of full load. If the modules are not sharing load, refer to the appropriate part of the float and equalize adjustments detailed in Paragraphs 5.02 and 5.03.

4. OPERATION

Starting and Stopping

NOTE

If the DC OUTPUT circuit breaker is operated to the OFF position while the AC INPUT circuit breaker is in the ON position, the AC INPUT circuit breaker will trip open.

4.01 Normal Start-Up Procedure: To start rectifier module operation, place the AC INPUT circuit breaker to the ON position, then place the DC OUTPUT circuit breaker to the ON position. If the AC INPUT circuit breaker immediately trips open, place it back to the ON position before operating the DC OUTPUT circuit breaker. The DC OUTPUT and AC INPUT circuit breakers are located at the upper right-hand corner of the rectifier module front panel. If the AC INPUT circuit breaker remains in the ON position following a commercial AC power failure, the rectifier module will start automatically when power is restored.

4.02 Stopping Procedure: To stop rectifier module operation, place the AC INPUT circuit breaker to the OFF position, then place the DC OUTPUT circuit breaker to the OFF position.

4.03 Module Testing Start-Up Procedure: Insure that the DC OUTPUT circuit breaker is in the OFF position. Place the AC INPUT circuit breaker to the ON position. Immediately turn back ON the AC INPUT circuit breaker if it trips open. When finished with module testing, place the DC OUTPUT circuit breaker to the ON position to return to normal operation.

Controls and Indicators

4.04 The following controls and light emitting diodes (LEDs) are located on the front panel of each rectifier plug-in module. Refer to Figure 4-1 for location.

a) AC INPUT Circuit Breaker: This circuit breaker connects or disconnects AC input power to the rectifier circuits.

b) DC OUTPUT Circuit Breaker: This circuit breaker opens the rectifier module's negative output lead. If this circuit breaker is operated to the OFF position either manually or automatically, the AC INPUT circuit breaker of that module trips open. Also, local and remote alarms are activated. If the AC INPUT circuit breaker is then turned back on, the rectifier automatically transfers to internal voltage sense. The DC OUTPUT circuit breaker has a mechanical interlock which prevents a rectifier module from being plugged into or pulled out of a shelf with the circuit breaker left in the ON position.

c) CURRENT LIMIT Potentiometer: Refer to the ADJUSTMENTS section of these instructions for a description of the operation of this control.

d) FLOAT Potentiometer: Refer to the ADJUSTMENTS section of these instructions for a description of the operation of this control.

e) EQ (Equalize) Potentiometer: Refer to the ADJUSTMENTS section of these instructions for a description of the operation of this control.

f) HVSD (High Voltage Shutdown) Potentiometer: Refer to the ADJUSTMENTS section of these instructions for a description of the operation of this control.

g) AC ON Indicator: This green light emitting diode illuminates when AC power is available to the rectifier module and the AC INPUT circuit breaker is in the ON position.

h) OPEN SNS (Open Sense Lead / Open Output Circuit Breaker) Indicator: This yellow light emitting diode illuminates if an external sense lead opens or the DC OUTPUT circuit breaker of the rectifier module opens either manually or automatically. In addition, ground (+BAT) is extended for activation of external alarms and the rectifier automatically transfers to internal voltage sense. A separate alarm terminal is provided for each rectifier module.

i) RFA (Rectifier Fail Alarm) Indicator: If any condition occurs which disables rectifier module output (as listed in Paragraph 1.13), this red LED illuminates.

In addition, resistive battery (-BAT) is extended for activation of external alarms. Under normal conditions, ground (+BAT) is supplied. A separate alarm terminal is provided for each rectifier module.

Also, a resistive ground (+BAT) external alarm terminal is provided as described in Paragraph 3.11.

j) FAN FAIL Indicator: This red light emitting diode illuminates when the rectifier module internal fan fails. In addition, ground (+BAT) is extended for activation of external alarms. A separate alarm terminal is provided for each rectifier module.

k) RECT CUR Indicator: These ten green light emitting diodes indicate, in increments of 5 amperes, the load that the rectifier module is supplying. Each segment will be fully lit at its designated current, ± 2 amperes.

l) RECT TEST Switch: To increase rectifier module output voltage by approximately one volt, operate the switch to the up position. To decrease rectifier module output voltage by approximately one volt, operate the switch to the down position. When the switch is released, rectifier output voltage returns to the normal setting.

Test Jacks

4.05 RECT VOLT and OUT CUR: These pin jacks are provided on each rectifier module front panel and provide a convenient method of connecting an external high impedance DC voltmeter. A voltmeter connected to the RECT VOLT jacks monitors rectifier module output voltage at the point of regulation. A voltmeter connected to the OUT CUR jacks monitors a voltage that is proportional (1 millivolt = 1 ampere) to module output current.

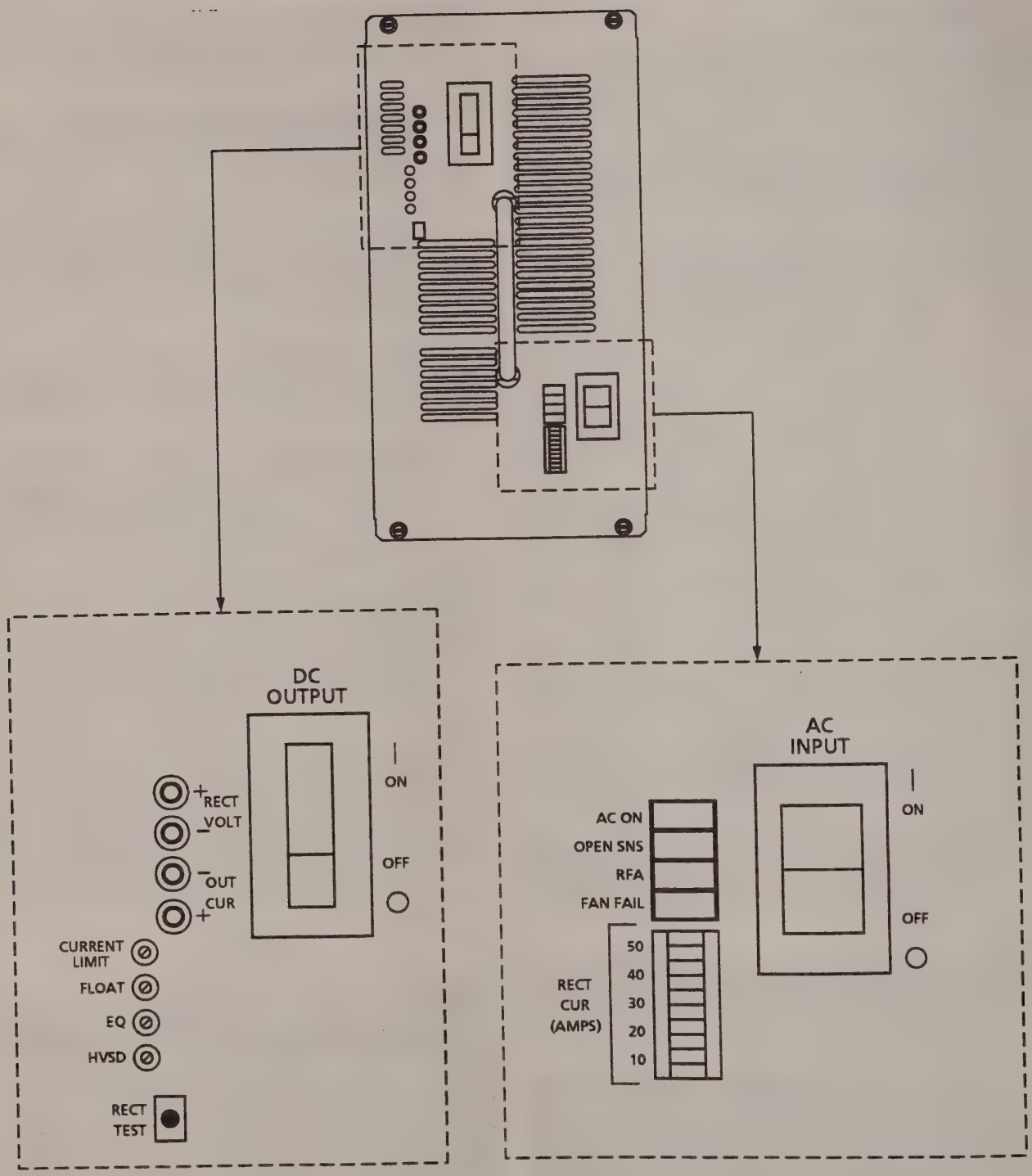


Figure 4-1. Front View

Float Charging

4.06 Because of the constant voltage output of the rectifier, output current remains equal to load current as long as load current does not exceed the current limit setting. During normal operation, the battery is not required to furnish load current and remains in a fully charged condition.

NOTE

If the current demanded by the load exceeds the current limit setting of the rectifier, the battery is required to furnish the difference in load current and begins discharging.

Equalize Charging

4.07 When using this rectifier to charge a conventional flooded cell battery, higher charging voltage (equalize voltage) is sometimes required to equalize the charge on all battery cells. Selection of the equalize mode is controlled by operation of the control panel of the associated power board.

WARNING

Do not supply equalize voltage for a longer period than necessary. Prolonged higher charge voltage will overcharge the battery cells and reduce battery life.

High Voltage Shutdown

4.08 Perform the following procedure to restart a rectifier module that was shut down and locked out due to a high voltage condition or application of a remote high voltage shutdown signal.

a) Place the AC INPUT circuit breaker to the OFF position.

b) Place the AC INPUT circuit breaker to the ON position. The high voltage shutdown circuit is now reset.

4.09 Back Up HVSD: If output voltage exceeds a preset non-adjustable value (above the high voltage shutdown value), the AC INPUT circuit breaker trips open, shutting down the module. The AC INPUT circuit breaker must be manually reset to restart the rectifier module.

High Temperature Inhibit

4.10 The rectifier module power conversion circuitry is inhibited if internal temperature of the module rises above a predetermined level. When temperature decreases to a safe level, the module automatically restarts.

Low Input Voltage Inhibit

4.11 If the AC input voltage decreases below a preset value, the rectifier module power conversion circuitry inhibits, disabling module output. When AC input voltage increases above another preset value, the rectifier module automatically restarts.

Open Sense Lead / Open Output Circuit Breaker Alarm

4.12 Voltage sensing leads must be extended from rectifier shelf to battery or load terminals. If the sense leads are not connected, local and remote alarms are activated and the rectifiers automatically transfer to internal voltage sensing. This alarm is also activated if the DC OUTPUT circuit breaker is operated to the OFF position either manually or automatically.

Emergency Shutdown

4.13 To restart the rectifier modules after an emergency shutdown, remove the emergency shutdown signal and then return the AC INPUT circuit breaker of each module to the ON position.

Remote On/Off (TR)

4.14 To restart a rectifier module after a remote stop (TR), remove the remote stop signal.

5. ADJUSTMENTS

General

5.01 All control potentiometers intended for customer adjustment are accessible through the front panel of each plug-in rectifier module. These potentiometers have been factory set, and the setting checked during the Initial Startup and Checkout procedure outlined in these instructions. Periodic readjustment of these potentiometers is not normally required. If adjustment becomes necessary, the following procedures may be performed.

DANGER

The following procedures are performed with power applied to the rectifier. This rectifier operates from AC voltage capable of producing fatal electrical shock. AC input voltage may be present at the AC input terminals of the rectifier. Battery voltage is present at the shelf DC output terminals, extended reference leads, and throughout the power system. Servicing personnel must observe all safety precautions normally associated with maintenance and adjustment of electronic equipment, and must avoid direct contact with any energized electrical termination. This rectifier produces high DC output current; therefore, servicing personnel must remove watches, rings, or other jewelry before making test equipment connections or performing adjustments.

Float Voltage Adjustment

5.02 General: Potentiometer FLOAT sets the float charge output voltage of the rectifier module. Unless otherwise specified, the float voltage of each rectifier module has been factory adjusted to 54.48 VDC at 50% of full rated load. If the type of battery to be used with the system is specified, the factory float setting is as shown in Table 3-8. Perform the following procedure to adjust the float voltage setting. The procedure detailed in Step a) is to be used to actually adjust the float voltage to a specific value without the use of an external load. The procedure detailed in Step b) is to be used when it is desired to adjust each rectifier module in the shelf to share the load.

a) Actual Float Voltage Adjustment

1) Operate the control panel of the associated power board as required to place the rectifier system into the float mode. Refer to the power board instruction manual if necessary. Allow the voltage to stabilize.

2) Connect a digital multimeter (DMM) set to indicate DC voltage to the RECT VOLT test points located on the front of the module under test. Observe correct polarity.

3) On the module under test, place first the AC INPUT circuit breaker to the OFF position, then the DC OUTPUT circuit breaker to the OFF position. Place the AC INPUT circuit breaker to the ON position. Immediately turn back ON the AC INPUT circuit breaker if it trips open.

4) Due to a controlled downslope of 0.275 volts from no load to full load, set the float voltage 0.135 volts higher than the desired float voltage value. Adjust potentiometer FLOAT clockwise to increase output voltage or counterclockwise to decrease output voltage. Make adjustments in small increments, and allow voltage to stabilize.

NOTE

If the rectifier module loses output voltage while adjusting the float voltage, adjust the HVSD potentiometer fully clockwise. Readjust the float voltage when the rectifier restarts. Refer to Paragraph 5.05 to adjust the high voltage shutdown point.

5) On the module under test, place the DC OUTPUT circuit breaker to the ON position.

6) Repeat Steps 2) through 5) for each of the remaining modules in the shelf.

NOTE

To insure proportionate sharing of the load between all rectifier modules in the shelf, the float voltage setting should be identical for all modules.

7) If the modules are not sharing the load properly, follow the procedure detailed in step b) of this paragraph.

8) When adjustment is completed, disconnect the DMM test probes. This completes the float voltage adjustment.

b) Float Voltage Adjustment for Load Sharing

1) Connect a digital multimeter (DMM) set to indicate DC voltage to the shelf DC output terminals. Observe correct polarity.

2) Operate the control panel of the associated power board as required to place the rectifier in the float mode. Observe the DMM reading.

3) If voltage is high:

A) Check the RECT CUR indicator on each module to determine which module(s) is supplying higher voltage. A current reading higher than the other modules indicates a higher output voltage.

B) Adjust potentiometer FLOAT on these modules counterclockwise to decrease the output voltage. Make adjustments in small increments, and allow the voltage to stabilize. When the RECT CUR LEDs indicate that the modules are sharing the load equally, and the DMM reading indicates correct float voltage, adjustment is complete.

4) If voltage is low:

A) Check the RECT CUR indicator on each module to determine which module(s) are supplying lower voltage. A current reading lower than the other modules indicates a lower output voltage.

B) Adjust potentiometer FLOAT on these modules clockwise to increase the output voltage. Make adjustments in small increments, and allow the voltage to stabilize. When the RECT CUR LEDs indicate that the modules are sharing the load equally, and the DMM reading indicates correct float voltage, adjustment is complete.

5) When adjustments are complete, remove the test equipment.

Equalize Voltage Adjustment

5.03 Potentiometer EQ sets the equalize charge output voltage of the rectifier module. Unless otherwise specified, the equalize voltage of each rectifier module has been factory adjusted to 56.00 VDC. If the type of battery to be used with the system is specified, the factory equalize setting is as shown in Table 3-8. Perform the following procedure to adjust the equalize voltage setting. The procedure detailed in Step a) is to be used to actually adjust the equalize voltage to a specific value without the use of an external load. The procedure detailed in Step b) is to be used when it is desired to adjust each rectifier module in the shelf to share the load.

a) Actual Equalize Voltage Adjustment

1) Operate the control panel of the associated power board as required to place the rectifier system into the equalize mode. Refer to the power board instruction manual if necessary. Allow the voltage to stabilize.

2) Connect a digital multimeter (DMM) set to indicate DC voltage to the RECT VOLT test points located on the front of the module under test. Observe correct polarity.

3) On the module under test, place first the AC INPUT circuit breaker to the OFF position, then the DC OUTPUT circuit breaker to the OFF position. Place the AC INPUT circuit breaker to the ON position. Immediately turn back ON the AC INPUT circuit breaker if it trips open.

4) Due to a controlled downslope of 0.275 volts from no load to full load, set the equalize voltage 0.135 volts higher than the desired equalize voltage value. Adjust potentiometer EQ clockwise to increase equalize voltage or counterclockwise to decrease equalize voltage. Make adjustments in small increments, and allow voltage to stabilize.

5) On the module under test, place the DC OUTPUT circuit breaker to the ON position.

6) Repeat Steps 2) through 5) for each of the remaining modules in the shelf.

NOTE

To insure proportionate sharing of the load between all rectifier modules in the shelf, the equalize voltage setting should be identical for all modules.

7) If the modules are not sharing the load properly, follow the procedure detailed in step b) of this paragraph.

8) When adjustment is completed, disconnect the DMM test probes. This completes the equalize voltage adjustment.

b) Equalize Voltage Adjustment for Load Sharing

1) Connect a digital multimeter (DMM) set to indicate DC voltage to the shelf DC output terminals. Observe correct polarity.

2) Operate the control panel of the associated power board as required to place the rectifier in the equalize mode. Observe the DMM reading.

3) If voltage is high:

A) Check the RECT CUR indicator on each module to determine which module(s) is supplying higher voltage. A current reading higher than the other modules indicates a higher output voltage.

B) Adjust potentiometer EQ on these modules counterclockwise to decrease the output voltage. Make adjustments in small increments, and allow the voltage to stabilize. When the RECT CUR LEDs indicate that the modules are sharing the load equally, and the DMM reading indicates correct equalize voltage, adjustment is complete.

4) If voltage is low:

A) Check the RECT CUR indicator on each module to determine which module(s) is supplying lower voltage. A current reading lower than the other modules indicates a lower output voltage.

B) Adjust potentiometer EQ on these modules clockwise to increase the output voltage. Make adjustments in small increments, and allow the voltage to stabilize. When the RECT CUR LEDs indicate that the modules are sharing the load equally, and the DMM reading indicates correct equalize voltage, adjustment is complete.

5) When adjustments are complete, remove the test equipment.

Current Limit Adjustment

5.04 Potentiometer CURRENT LIMIT sets the point to which rectifier module output current is limited. Unless otherwise specified, each rectifier module is factory adjusted to limit current at 105% of full load. Perform the following procedure to adjust the current limit setting.

CAUTION

Performing certain steps in the following procedure will activate local and remote rectifier fail alarms. Remote alarms should be disabled if possible, or office personnel should be notified that testing is in progress.

NOTE

Operating the rectifier modules at current greater than 105% of full load at an ambient temperature of 65°C will cause periodic shutdown due to overheating. The rectifier will automatically restart when module cools down.

a) Connect a digital multimeter (DMM) set to indicate DC voltage to the OUT CUR test points located on the front of the module under test. Observe correct polarity.

b) Operate and hold the RECT TEST switch on the module under test to the up position. This increases the module's output voltage by approximately one volt. This module will try to provide the total load, and if the load is great enough, it will go into current limit. If not, a resistive test load will have to be connected to the rectifier shelf output terminals. Insure that the rectifier module under test is supplying greater than 100% of full load, as indicated on the DMM.

c) Multiply the reading on the multimeter (in millivolts) by 1 to obtain the output current (in amperes) of the rectifier module (eg. 1 millivolt=1 ampere). This is the current limit setting. To decrease the current limit setting, adjust potentiometer CURRENT LIMIT counterclockwise (CCW) until the output current decreases to the desired limit. To increase the current limit setting, adjust potentiometer CURRENT LIMIT clockwise (CW) until the output current increases to the desired limit.

d) When the current limit setpoint is as desired, release the RECT TEST switch. Remove the DMM test leads from the module.

e) Repeat Steps a) through d) for each of the remaining modules in the shelf.

f) When adjustment is completed on all modules, remove the test equipment. This completes the current limiting adjustment procedure.

High Voltage Shutdown Adjustment

5.05 Potentiometer HVSD sets the rectifier module high voltage shutdown voltage level. Unless otherwise specified, each rectifier module is factory adjusted for a high voltage shutdown point of 59.5 volts. Perform the following procedure to adjust the high voltage shutdown setting.

a) Check the control panel of the associated power board to insure that the rectifier system is in the float mode of operation. Refer to the power board instruction manual if necessary.

b) On each rectifier module, place first the AC INPUT circuit breaker to the OFF position, then the DC OUTPUT circuit breaker to the OFF position.

c) Connect a digital multimeter (DMM) set to indicate DC voltage to the RECT VOLT test points located on the front of the module under test. Observe correct polarity.

d) On the module under test, place the AC INPUT circuit breaker to the ON position. Immediately turn back ON the AC INPUT circuit breaker if it trips open.

e) On the module under test, adjust potentiometer HVSD fully clockwise.

f) Note the output voltage indicated on the DMM for later reference.

g) Adjust potentiometer FLOAT for the output voltage value which equals the desired shutdown level.

h) Adjust potentiometer HVSD slowly counter-clockwise until the rectifier inhibits as indicated by the loss of module output voltage. The module will automatically restart in approximately 3 seconds. Immediatly adjust potentiometer FLOAT counterclockwise approximately 1-turn (to prevent lockout).

NOTE

If after an initial high voltage shutdown. the rectifier module output again exceeds the high voltage shutdown value within 5 minutes. the module will shutdown and lockout. Refer to Paragraph 4.08 for a restart procedure.

i) After the module has automatically restarted, note the output voltage indicated by the DMM while slowly adjusting potentiometer FLOAT clockwise. Continue adjusting potentiometer FLOAT until shutdown occurs, and note the shutdown voltage level. The module will automatically restart in approximately 3 seconds. Immediatly adjust potentiometer FLOAT counterclockwise approximately 1-turn (to prevent lockout).

j) If the shutdown voltage level is satisfactory, no further adjustment is required. If the desired voltage level is not attained, repeat Steps g) through i).

k) When the desired shutdown level is attained, adjust potentiometer FLOAT for the output voltage value originally noted in Step f).

l) On the module under test, place the AC INPUT circuit breaker to the OFF position.

m) Repeat Steps c) through l) for each of the remaining modules in the shelf.

n) When adjustment is completed, disconnect the DMM test probes. This completes the high voltage shutdown adjustment.

6. TROUBLESHOOTING

General

6.01 The Fault Isolation Chart included in these instructions is designed to aid service personnel in locating a possible failure in the rectfier. The chart is in the form of a flow diagram containing interrogatory and directive statements in diamond-shaped and rectangular geometric figures, respectively. A yes or no response sufficiently answers each inquiry, and the servicing technician should follow each yes or no line of flow to the next inquiry or directive statement. The directive statements require that the technician perform

an adjustment or test to verify certain operational conditions. If the line of flow terminates in a block entitled POSSIBLE CAUSES, the servicing technician should check each cause listed and take appropriate corrective action if a possible fault condition is located.

Repair and Replacement Information

6.02 If the suspected cause of a trouble symptom is an out of adjustment condition, the particular adjustment setting should be checked or reset using the appropriate adjustment procedure.

6.03 When a trouble symptom is localized to a faulty plug-in module, that module should be replaced. No attempt should be made to troubleshoot or repair individual rectifier modules, except for fan replacement as described later in this section. When replacing rectifier modules, refer to Paragraph 3.21 and adjust Switch S1 to the same setting as that of the module being replaced.

NOTE

The DC OUTPUT circuit breaker has a mechanical interlock which prevents a rectifier module from being plugged into or pulled out of a shelf with the DC OUTPUT circuit breaker left in the ON position.

Fan Replacement

6.04 Each rectifier module utilizes a fan for cooling. If fan replacement should become necessary, perform the following procedure.

a) Place the AC INPUT circuit breaker of the module being serviced to the OFF position. Place the DC OUTPUT circuit breaker of the module being serviced to the OFF position.

b) Remove the module from the shelf by first loosening the captive fasteners on the module front panel.

c) Separate the two mating halves of the fan power lead connector. The connector is located to the right of the fan.

d) Note the position at which the power leads exit the fan body, so that the replacement fan can be oriented the same way.

e) Remove the screws that secure the fan to the rectifier. Remove the fan.

CAUTION

When installing the fan as described in the next step, direction of air flow is critical. failure to install the fan correctly may result in interrupted service or eventual failure of the rectifier.

f) Position the replacement fan (Lorain Part No. 243156001) on the module so that the direction of airflow, as indicated by an arrow on the fan body, is away from the module (fan should pull air through the module). Orient the fan so that the power leads are positioned as previously noted on the original. Secure the fan to the module by installing and tightening the previously removed screws. Do not overtighten.

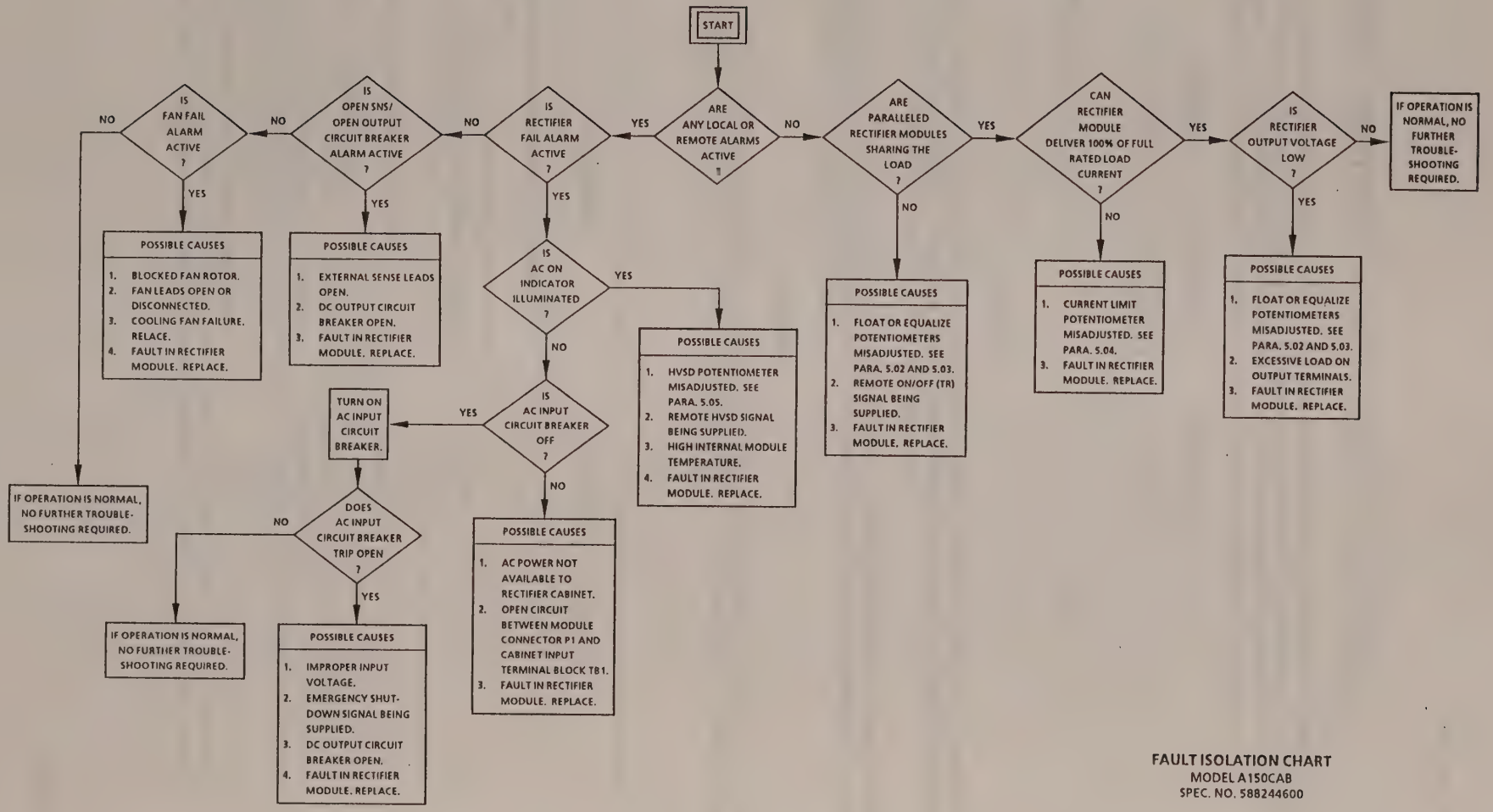
g) Reconnect the polarized fan power lead connector.

h) Install the rectifier module into the shelf, and return to service. With the fan operating, check the direction of airflow. The fan should be pulling air through the rectifier, from front to back. If airfow direction is wrong, immediately remove the module from service. Check for proper fan mounting, and correct as required before placing the rectifier module into service.

7. MODEL DATA

General

7.01 Refer to the Power Data sheet for information concerning input and output ratings, operating limits, dimensions, recommended input and output lead sizes, fusing and terminal lug capacity.


START
ARE ANY LOCAL OR REMOTE ALARMS ACTIVE ?
YES
NO
IS RECTIFIER FAIL ALARM ACTIVE ?
YES
NO
IS OPEN SNS/ OPEN OUTPUT CIRCUIT BREAKER ALARM ACTIVE ?
YES
NO
IS FAN FAIL ALARM ACTIVE ?
YES
NO
IF OPERATION IS NORMAL, NO FURTHER TROUBLE-SHOOTING REQUIRED.
POSSIBLE CAUSES
1. BLOCKED FAN ROTOR.
2. FAN LEADS OPEN OR DISCONNECTED.
3. COOLING FAN FAILURE. RELACE.
4. FAULT IN RECTIFIER MODULE. REPLACE.
POSSIBLE CAUSES
1. EXTERNAL SENSE LEADS OPEN.
2. DC OUTPUT CIRCUIT BREAKER OPEN.
3. FAULT IN RECTIFIER MODULE. REPLACE.
IS AC ON INDICATOR ILLUMINATED ?
YES
NO
POSSIBLE CAUSES
1. HVSD POTENTIOMETER MISADJUSTED. SEE PARA. 5.05.
2. REMOTE HVSD SIGNAL BEING SUPPLIED.
3. HIGH INTERNAL MODULE TEMPERATURE.
4. FAULT IN RECTIFIER MODULE. REPLACE.
IS AC INPUT CIRCUIT BREAKER OFF ?
YES
NO
TURN ON AC INPUT CIRCUIT BREAKER.
DOES AC INPUT CIRCUIT BREAKER TRIP OPEN ?
NO
YES
IF OPERATION IS NORMAL, NO FURTHER TROUBLE-SHOOTING REQUIRED.
POSSIBLE CAUSES
1. IMPROPER INPUT VOLTAGE.
2. EMERGENCY SHUT-DOWN SIGNAL BEING SUPPLIED.
3. DC OUTPUT CIRCUIT BREAKER OPEN.
4. FAULT IN RECTIFIER MODULE. REPLACE.
POSSIBLE CAUSES
1. AC POWER NOT AVAILABLE TO RECTIFIER CABINET.
2. OPEN CIRCUIT BETWEEN MODULE CONNECTOR P1 AND CABINET INPUT TERMINAL BLOCK TB1.
3. FAULT IN RECTIFIER MODULE. REPLACE.
ARE PARALLELED RECTIFIER MODULES SHARING THE LOAD ?
YES
NO
POSSIBLE CAUSES
1. FLOAT OR EQUALIZE POTENTIOMETERS MISADJUSTED. SEE PARA. 5.02 AND 5.03.
2. REMOTE ON/OFF (TR) SIGNAL BEING SUPPLIED.
3. FAULT IN RECTIFIER MODULE. REPLACE.
CAN RECTIFIER MODULE DELIVER 100% OF FULL RATED LOAD CURRENT ?
YES
NO
POSSIBLE CAUSES
1. CURRENT LIMIT POTENTIOMETER MISADJUSTED. SEE PARA. 5.04.
3. FAULT IN RECTIFIER MODULE. REPLACE.
IS RECTIFIER OUTPUT VOLTAGE LOW ?
YES
NO
IF OPERATION IS NORMAL, NO FURTHER TROUBLE-SHOOTING REQUIRED.
POSSIBLE CAUSES
1. FLOAT OR EQUALIZE POTENTIOMETERS MISADJUSTED. SEE PARA. 5.02 AND 5.03.
2. EXCESSIVE LOAD ON OUTPUT TERMINALS.
3. FAULT IN RECTIFIER MODULE. REPLACE.

FAULT ISOLATION CHART
MODEL A150CAB
SPEC. NO. 588244600

FLOTROL® RECTIFIER MAINTENANCE SCHEDULE

The following is a list of procedures and checks which will aid any qualified servicing technician in identification and/or prevention of trouble symptoms in a rectifier. The procedures in the table are referenced to the specific paragraphs, which appear in the rectifier instruction manual. It is recommended that these procedures are performed and recorded at the intervals specified to maintain an adequate service record of each rectifier.

MODEL	SPEC. NO.	SERIAL NO.
A150CAB	588244600/ 486526401	_____

SERVICING TECHNICIAN _____ DATE _____

DANGER

Hazardous AC voltages capable of producing severe, perhaps fatal electrical shock are present at various locations in the rectifier cabinet. Exercise caution when working inside the rectifier cabinet, to assure that contact is not made with any electrical termination.

The rectifier produces high DC output current; therefore, the servicing technician must remove watches, rings, or other jewelry before performing any procedure requiring the technician to be in close vicinity with energized electrical terminations.

CAUTION

Performing the 12 month interval procedures may cause service interruptions. Insure that the batteries are fully charged or redundant rectifiers are capable of maintaining the load before performing any of these procedures.

INTERVAL	PROCEDURE	PARA. NO.	VALUE	√
6 Month	Clean Ventilation Openings and Heat Sink Surfaces	–	–	
	Measure and Record Float/Equalize Voltages	5.02 and 5.03		
	Inspect all Installer's Connections	3.03- 3.19 and 3.29	–	
12 Month	Check Rectifier Fail Alarm	4.04 i)	–	
	Check and Adjust Float/Equalize Voltage	5.02 and 5.03		
	Check and Adjust Current Limit	5.04		
	Check and Adjust High Voltage Shutdown	5.05		

NOTE: *This maintenance schedule may be reproduced as necessary to record and document rectifier performance.*

APPENDIX

RECORD OF INSTRUCTION CHANGES		
ISSUE OR DATE	PRN	DESCRIPTION OF CHANGE
A1	-	NEW
B1	183-6277	Revised fo reflect new rectifier module part number (was 486526400). Added Figure 4-1.

1. SPECIFICATION

1.1 GENERAL: This Modular Rectifier System consists of an equipment mounting shelf which can accommodate up to three separately ordered rectifier plug-in modules (Part No. 486526401). The shelf and modules comprise a rectifier system which is designed to power a load while charging a positive grounded battery. This rectifier system is specified for use as a battery eliminator. The rectifier system is finished in equipment light gray.

1.2 OUTPUT RATINGS

1.2.1 Voltage: Float voltage is adjustable from 48 to 58 volts DC for floating a 23 or 24 cell battery. Equalize voltage is adjustable from 53 to 60 volts DC for equalizing a 23 or 24 cell battery. Unless otherwise specified, the factory float and equalize settings are 54.48 VDC and 56.00 VDC, respectively. If the type of battery to be used with the system is specified, the factory float and equalize settings are as shown in Table 1. Float or equalize voltage may be selected from a remote location. No local control is provided.

Adjustment	Factory Setting (Limited Maintenance Batteries)	Conventional Flooded Cell Battery Setpoints
Float Voltage	54.48 VDC	52.08 VDC
Equalize Voltage	56.00 VDC	54.00 VDC

Table 1

1.2.2 Current:

Number of Modules	Current
1	50A
2	100A
3	150A

ISSUE	CHG NO	DESCRIPTION
EA	LLP-001945	Added recommended torque to Installer's Information. 5/13/99 MAY 24 1999 B P
E1	183-7210	Para. 1.3.1: Input voltage range qualified. DD 05/07/97 MAY 07 1997 BP M PRN
D1	183-6895	Added Paragraph 1.5.12. JB 1/9/97 JAN 15 1997 BP M PRN

RELTEC® Power Products

POWER DATA
LORAIN® MODEL A150CAB
RECTIFIER MOUNTING SHELF
SPEC. NO. 588244600
EQUIPPED WITH
SPEC. NO. 486526401 RECTIFIER MODULES

DR BY	DATE	GRP LDR	DATE	
R. Lash	8/19/93	J. Giancaterino	8/19/93	PD588244600
CH BY D. Dembinski	DATE 8/19/93	APP BY R. Kurish	DATE 8/19/93	
ENGR BY D. Michlovic	DATE 8/19/93			

1. SPECIFICATION

1.2 OUTPUT RATINGS (CONT'D)

1.2.3 Regulation

(A) Steady state output voltage remains within ±0.5% of any voltage within the range of 48.0 VDC to 58.0 VDC for any load current from no load to full load and for any input voltage and frequency specified below as measured at the rectifier output terminals. Applies when the rectifier sense leads are connected to the DC output terminals of the rectifier shelf.

(B) For any step load change within the range of 20% to 100% of rated output current, the maximum voltage transient will not exceed ±5% of the initial steady state voltage when the rectifier output is connected to a battery with an ampere-hour rating of four times the full load current rating. Recovery to within steady state voltage regulation range does not exceed 40 milliseconds, and all transient behavior disappears within 50 milliseconds. Refer to Paragraph 1.8.1.

1.2.4 **Filtering:** When this rectifier is connected to a battery with an ampere-hour rating of four times the full load current rating, the following specifications apply:

(A) Voice band noise is less than 32 dBrn with C-message weighting.

(B) Wide band noise does not exceed 500 millivolts peak-to-peak or 50 millivolts rms.

1.3 INPUT RATINGS

1.3.1 **Voltage:** Nominal 208/240 volts, single phase, 50 to 60 Hz, with voltage range of 176 to 254 volts. The acceptable frequency range is 47 to 63 Hz. When the rectifier is operated in an ambient temperature of +65°C (+149°F) and input frequency is 47 Hz, acceptable input voltage range is 184 to 254 volts.

1. SPECIFICATION

1.3 INPUT RATINGS (CONT'D)

1.3.2 Typical Input Data at 60 Hz.- When equipped with one 50 ampere rectifier module.

(A) Rectifier initially adjusted to 54.00 volts output.

Input Voltage	Percent of Full Load	Input Current (Amperes)	Input VA	Input Watts	Efficiency %	Power Factor
208	0	0.5	94	39	--	.417
	25	4.5	930	824	83.6	.886
	50	7.9	1643	1584	85.2	.964
	75	11.7	2427	2371	85.6	.977
	100	15.7	3274	3193	84.4	.975
240	0	0.5	108	44	--	.407
	25	4.4	1061	833	81.1	.785
	50	7.0	1668	1598	85.2	.958
	75	10.5	2515	2390	84.9	.950
	100	13.8	3307	3207	84.6	.970

(B) Power Factor is .90 or better above 50% of full load.

(C) Maximum input currents at 105% load and specified output voltage.

Nominal Input	Input Voltage	Output Voltage	Current (Amperes)
208/240 VAC	176	58.0 VDC	21.5
	184	58.0 VDC	20.3

1.4 STANDARD FEATURES

1.4.1 **Rectification System:** High Frequency

1.4.2 **Input Protection:**

(A) A two pole AC INPUT circuit breaker in each rectifier plug-in module opens both sides of 208/240 volt service to the module.

(B) If the AC input voltage decreases below approximately 158 volts the rectifier module power conversion circuitry inhibits, disabling module output. When AC input voltage increases to approximately 172 volts the rectifier module will automatically restart.

1. SPECIFICATION

1.4 STANDARD FEATURES (CONT'D)

1.4.3 Output Protection:

(A) **Short Circuit:** A DC OUTPUT circuit breaker is located in the negative output lead of each rectifier module. If this circuit breaker is operated to the OFF position either manually or automatically, the AC INPUT circuit breaker of that module trips open. Also, local and remote alarms are activated. If the AC INPUT circuit breaker is then turned back on, the rectifier automatically transfers to internal voltage sense. The DC OUTPUT circuit breaker has a mechanical interlock which prevents a rectifier module from being plugged into or pulled out of a shelf with the circuit breaker left in the ON position.

(B) **Current Limiting:** A circuit adjustable from 50% to 105% of rated full load limits DC output current. Unless otherwise specified, the factory setting is 105% of rated full load.

(C) **High Voltage Shutdown:**

(1) **Internally Selective:** If rectifier module output voltage exceeds an adjustable preset value, the module will shut down. After approximately 3 seconds, the module will automatically restart. If the rectifier module output voltage again exceeds the high voltage shutdown value within 5 minutes, the module will shut down and lock out. If the rectifier does not experience a high voltage condition within the 5 minute time period, the restart circuit is reset.

If two or more rectifier modules are present in the shelf, or if the shelf is paralleled with other rectifiers, only the rectifier module causing the high voltage condition shuts down. This is accomplished by increasing the preset high voltage shutdown point by 2 to 3 volts when the rectifier module is delivering less than 3 amperes of current. If one rectifier module experiences a high voltage condition, it is assumed that this rectifier module will provide the load and that the others will deliver less than 3 amperes of current. This will cause their high voltage shutdown point to shift 2 to 3 volts higher than that of the faulty rectifier module. The faulty rectifier module shuts down. The other rectifier modules pick up the load and their high voltage shutdown point is returned to normal.

The high voltage shutdown circuit is adjustable through the range of 48 to 60 volts DC. Unless otherwise specified, the factory setting is 59.5 volts.

The high voltage shutdown range and setpoint are automatically increased by 2 to 3 volts when the rectifier module is placed in the equalize charge mode. This is in addition to the 2 to 3 volts increase if the rectifier is delivering less than 3 amperes of current as described above.

(2) **Back-Up:** If rectifier module output voltage exceeds a second preset (non-adjustable) value (60 to 65 volts DC), the AC INPUT circuit breaker trips open, shutting down the module. The AC INPUT circuit breaker must be manually re-set to re-start the rectifier module.

(3) **Remote High Voltage Shutdown:** The rectifier modules can be shut down from a remote location. Application of ground (+BAT) activates the selective high voltage shutdown circuit of each module. The ground (+BAT) signal must be removed within 200 milliseconds. Due to the selective nature of the shutdown circuit, only rectifier modules delivering 3 amperes or more of current shut down.

1. SPECIFICATION

1.4 STANDARD FEATURES (CONT'D)

1.4.4 **External Voltage Sensing:** Voltage sensing leads must be extended from rectifier shelf to battery or load terminals. If the sense leads are not connected, local and remote alarms are activated and the rectifiers automatically transfer to internal voltage sense.

1.4.5 **Status and Alarm Indicators:** The following indicators are located on each rectifier module. Refer to Section 3. INSTALLER'S CONNECTIONS and Section 4. INSTALLER'S INFORMATION NOTES of this Power Data Sheet for a description of the external alarms.

(A) **AC ON Indicator:** This green light emitting diode illuminates to indicate that AC power is applied to the rectifier module and the AC INPUT circuit breaker is ON.

(B) **OPEN SNS (Open Sense Lead/Open Output Circuit Breaker) Indicator:** This yellow light emitting diode illuminates if an external sense lead opens or the DC OUTPUT circuit breaker of the rectifier module opens either manually or automatically. In addition, ground (+BAT) is extended for activation of external alarms and the rectifier automatically transfers to internal voltage sense. A separate alarm terminal is provided for each rectifier module.

(C) **RFA (Rectifier Fail Alarm) Indicator:** If any condition listed below occurs which disables rectifier module output, this red LED illuminates.

In addition, resistive battery (-BAT) is extended for activation of external alarms. Under normal conditions, ground (+BAT) is supplied. A separate alarm terminal is provided for each rectifier module. Refer to Paragraphs 4.11, 4.12, and 4.13.

Also, a resistive ground (+BAT) external alarm terminal is provided as described in Paragraphs 1.4.6 and 4.20.

(1) Complete failure of AC input voltage, or decrease of AC input voltage below a predetermined level.

(2) AC input circuit breaker switched off, either manually or automatically. The AC input circuit breaker automatically trips open during an input overcurrent condition, a back-up high voltage shutdown condition, when the emergency shutdown circuit is activated, when input bank voltage exceeds a predetermined value, or when the DC output circuit breaker is opened.

(3) Rectifier output voltage exceeds the high voltage shutdown setting.

(4) Internal temperature of module exceeds a preset value which inhibits the power conversion circuit.

(5) Any failure condition that disables rectifier output.

(D) **FAN FAIL Indicator:** This red light emitting diode illuminates when the rectifier module internal fan fails. In addition, ground (+BAT) is extended for activation of external alarms. A separate alarm terminal is provided for each rectifier module.

(E) **RECT CUR Indicator:** These ten green light emitting diodes indicate, in increments of 5 amperes, the load that the rectifier module is supplying. Each segment will be fully lit at its designated current, ± 2 amperes.

1. SPECIFICATION

1.4 STANDARD FEATURES (CONT'D)

1.4.6 **Rectifier Fail Alarm (resistive ground):** If any condition occurs which disables the output of any rectifier module in the shelf, resistive ground or ground (+BAT) is supplied for operating customer-furnished external alarms. Under normal conditions, resistive ground or ground is removed. The value of the resistance varies depending on the number of failed modules, so that a compatible alarm and control panel can issue a minor or major alarm as required. A four position switch is provided on each rectifier module which allows selection of three separate groups of resistance values. This allows the rectifier shelf to be interfaced with a variety of alarm and control panels using impedance matching for identifying minor and major alarms. The fourth position of the switch enables the rectifier module to supply a ground (+BAT) signal (1 ampere at 30 VDC, 0.3 ampere at 110 VDC) when used without impedance matching alarm panels. Refer to Table 2 for resistance values of the three groups. Refer also to the rectifier shelf instructions for an adjustment procedure, and appropriate switch settings for various LORAIN alarm and control panels. Conditions which result in a Rectifier Fail Alarm are listed in Paragraph 1.4.5 (C).

No. of Failed Modules	Alarm Resistance Value (Ohms) Group 1	Alarm Resistance Value (Ohms) Group 2	Alarm Resistance Value (Ohms) Group 3
1	27.4K	41.2K	10K
2	13.7K	20.6K	5K
3	9.13K	13.73K	3.33K

Table 2

1.4.7 **Meter Test Points:** Insulated test points are provided as a convenient method of connection of an external high impedance DC voltmeter to monitor rectifier output current, and the voltage at the point of regulation.

1.4.8 **Rectifier Module Test Switch:** A momentary three position test switch (RECT TEST) is provided on each rectifier module. This switch allows the output voltage of the module to be momentarily increased or decreased by one volt for module testing purposes.

1.4.9 **Shunt Output:** A signal that is proportional (1 millivolt = 1 ampere) to output current (shunt output) is available from each rectifier module.

1.4.10 **Remote Equalize:** All rectifier modules are placed into the equalize charge mode by application of a ground (+BAT) signal. The rectifier modules are placed into float charge mode when the ground (+BAT) signal is removed. (No local control is provided.)

1.4.11 **Remote On/Off (TR):** A rectifier module can be inhibited by application of a ground (+BAT) signal. Rectifier module is restarted when the ground (+BAT) signal is removed. No rectifier fail alarm is issued when rectifier is shut down in this manner. A separate remote on/off (TR) terminal is provided for each rectifier module (except when accessory terminal block is used).

1.4.12 **Emergency Shutdown:** The AC INPUT circuit breakers of all rectifier modules in the shelf can be tripped open from a remote location by application of a ground (+BAT) signal. Rectifiers must then be manually restarted.

1.4.13 **Cooling:** Forced convection. Each rectifier module is equipped with one cooling fan. If the fan fails, local and remote alarms are activated. Also, if the internal temperature of the module exceeds a preset value, the rectifier module power conversion circuitry is inhibited. When temperature decreases to a safe level, the rectifier module will automatically restart.

1. SPECIFICATION

1.4 STANDARD FEATURES (CONT'D)

1.4.14 **Rectifier Self Test Features:** A circuit monitors power transformer primary current. If for any reason primary current is absent, a test signal is activated. If the power conversion circuitry does not respond to the test signal, the Rectifier Fail Alarm is activated. NOTE: Shutting down the rectifier with a Remote On/Off (TR) signal will inhibit the rectifier fail alarm. (See Paragraph 1.4.11.)

1.4.15 **Paralleling:** This rectifier system can be connected in parallel with other Model A150CAB rectifier shelves.

1.4.16 **Load Sharing:** Programmed Slope Control

1.4.17 **Output Current Walk-In:** Following application of AC input power, output current typically increases to 25% of full load in 3.0 seconds, 50% of full load in 5.0 seconds, 75% of full load in 8.0 seconds, and 100% of full load in 10.0 seconds.

1.4.18 **Mounting:** This rectifier shelf is designed for mounting in a 23 inch wide relay rack with 1 or 1-3/4 inch multiple drilling.

1.4.19 A blank panel is provided for any unused module position.

1.5 ENVIRONMENTAL RATINGS

1.5.1 **Operating Ambient Temperature Range:** -40°C to +65°C (-40°F to +149°F)

1.5.2 **Storage Temperature Range:** -40°C to +85°C (-40°F to +185°F)

1.5.3 **Humidity:** This rectifier is capable of operating in an ambient relative humidity range of 0 to 95%, noncondensing.

1.5.4 **Altitude:** The maximum operating ambient temperature should be derated by 10°C at an elevation of 10,000 feet above sea level. For elevations between 3,000 and 10,000 feet, derate the maximum operating ambient temperature linearly.

1.5.5 **Heat Dissipation(Typical);** Nominal input with output adjusted for 58 volts DC.

No. of Modules	Shelf Output Current (Amperes)	BTU/Hr
1	50	1704
2	100	3409
3	150	5113

1.5.6 **Ventilation Requirements:**

(A) **Ventilation:** The rectifier should be mounted so ventilating openings are not blocked and temperature of the air entering the shelf does not exceed the limits stated in Paragraph 1.5.1. Also, the distance from the rear of the rectifier cabinet to a wall or other solid structure must not be less than the following limits.

(1) Four (4) inches when the rectifier is operated in a +50°C (+122°F) ambient.

(2) Six (6) inches when the rectifier is operated in a +65°C (+149°F) ambient.

1. SPECIFICATION

1.5 ENVIRONMENTAL RATINGS (CONT'D)

1.5.6 Ventilation Requirements (Cont'd):

(B) Relay Rack Mounting Considerations: This rectifier system is designed for front to back ventilation to facilitate stacking of the rectifier shelves, one above the other, in a 23 inch relay rack with 1 or 1-3/4 inch multiple mounting holes.

1.5.7 Audible Noise - With one rectifier module installed: The audible noise at any point five feet from any vertical surface of the rectifier shelf does not exceed 65 dBA. when measured with a Sound Level Meter conforming to ANSI S1.4. Refer to Paragraph 1.8.1.

1.5.8 Surge Protection: This rectifier is capable of withstanding surges per ANSI/IEEE C 62.41-1980 Category B across the input terminals. Refer to Paragraph1.8.1.

1.5.9 Safety Compliance:

(A) This unit meets the requirements of UL 1950, Standard for Information Technology Equipment, and is UL Recognized as a power supply for use in telephone, electronic data processing or information processing equipment.

(B) This unit meets the requirements of CSA 22.2 No. 234-M90 and is Certified as a Component Type Custom Built Rectifier.

(C) This unit meets the requirements of EN 60950 (IEC 950) the European Standard for Information Processing Equipment. This unit is licensed by TUV for use with Information Processing and Telephone Equipment.

1.5.10 Seismic Compliance: This unit meets the requirements of TR-EOP-000063, Zone 4, upper level.

1.5.11 EMI/RFI Suppression: This unit conforms to the conducted and radiated noise requirements of FCC rules Part 15, Subpart B, for Class A computing devices.

1.5.12 European Compliance (CE): This product conforms to the EU EMC Directive 89/336/EEC and the following harmonized standards, EN55022 Class A and EN50082-1.

1.6 ACCESSORIES

1.6.1 Alarm and Control Wiring Terminal Block Assembly: This accessory provides screw-type terminals for alarm and control wiring connections. Specify one (1) of Part No. 483212100.

NOTE

This accessory must be installed by the customer after the cabinet is mounted to the relay rack. Refer to the cabinet instructions for an installation procedure.

1.6.2 AC Input Housing Kit: This accessory covers the rectangular opening provided on the cabinet for AC service entrance, and provides for use of 1/2" and 3/4" conduit. Specify one (1) of Part No. 418140300.

NOTE

This accessory must be installed by the customer after the cabinet is mounted to the relay rack. Refer to the instructions supplied with the kit for an installation procedure.

1. SPECIFICATION

1.7 RELATED DOCUMENTATION

1.7.1 Schematic Diagram: SD588244600

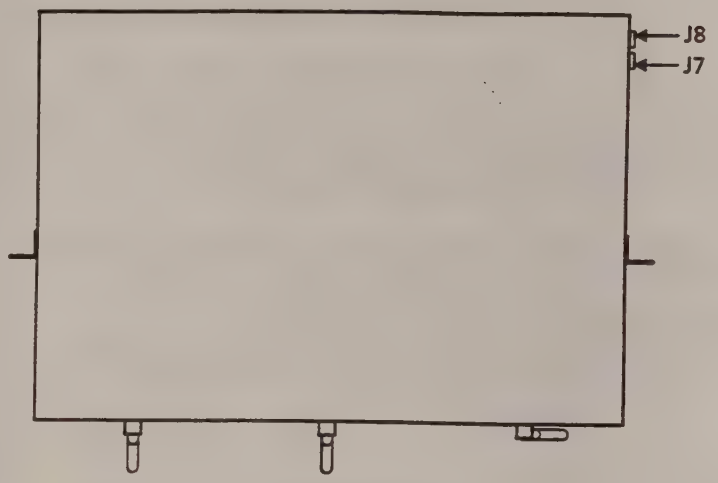
1.7.2 Wiring Diagram: T588244600

1.7.3 Instructions: Section 5463

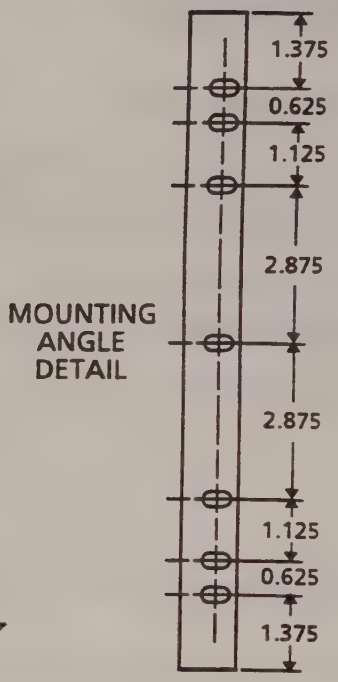
1.8 SPECIFICATION NOTES

1.8.1 This parameter is guaranteed by Engineering Design and is not production tested.

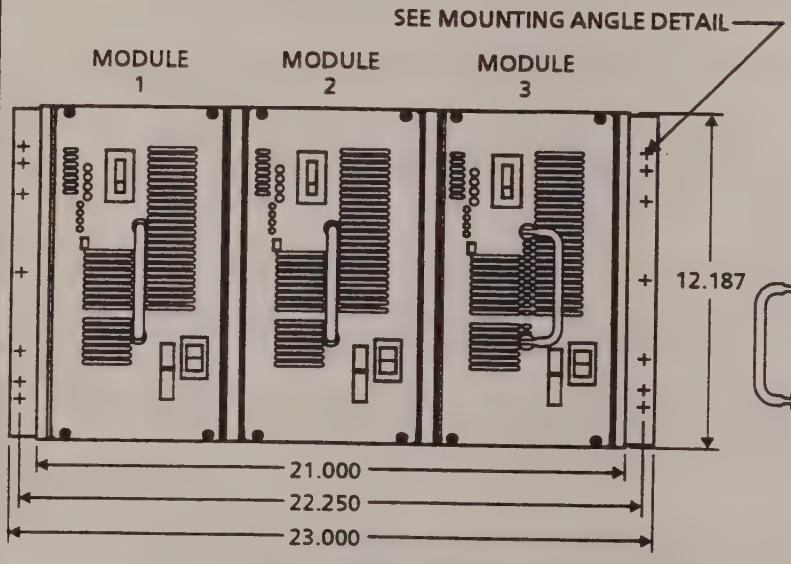
2. DIMENSIONS



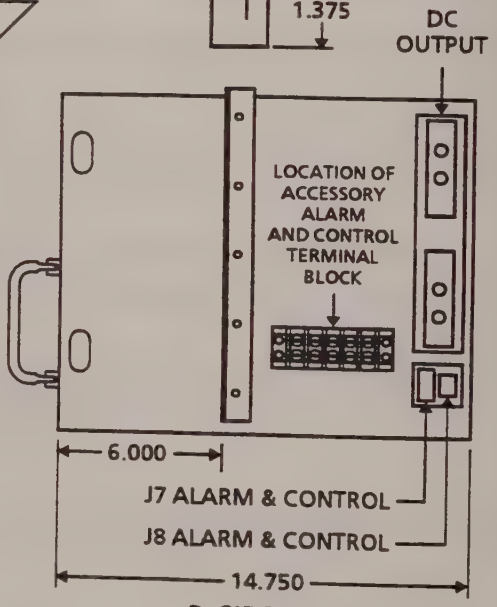
TOP VIEW



MOUNTING ANGLE DETAIL



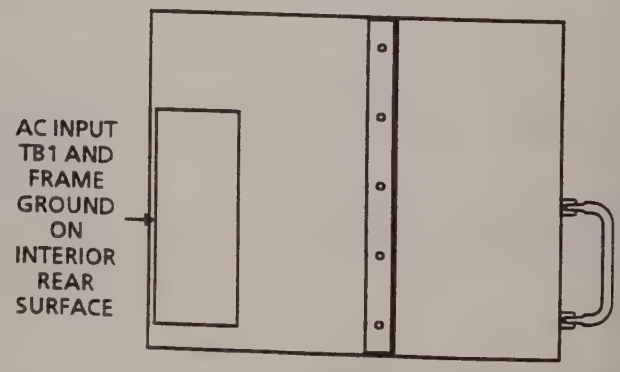
FRONT VIEW



R. SIDE VIEW

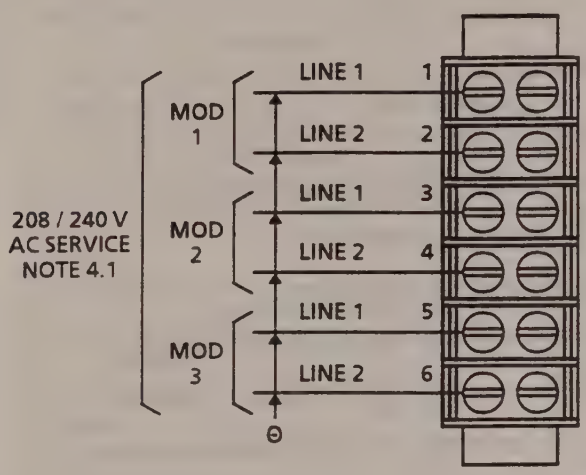
NOTES :

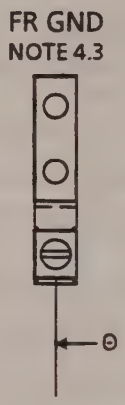
1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
2. WEIGHT IN LBS.
   - CABINET
     - NET : 28
     - SHIPPING : 42
   - MODULE
     - NET : 38.5
     - SHIPPING : 45.5
3. FINISH : EQUIPMENT LIGHT GRAY.
4. INDICATES VENTILATING GRILLE

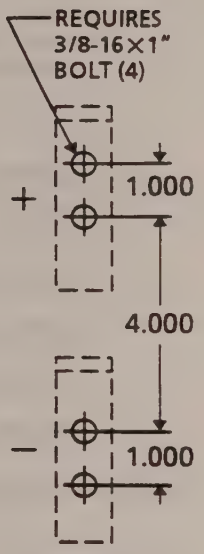


L. SIDE VIEW

3. INSTALLER'S CONNECTIONS

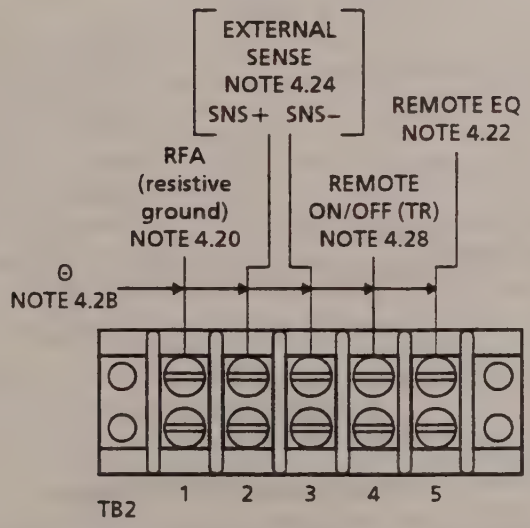






DC OUTPUT

DRILLED BUSBARS PROVIDED FOR INSTALLATION OF CUSTOMER FURNISHED LUGS. SEE NOTE 4.4 FOR RECOMMENDED LUG SIZE

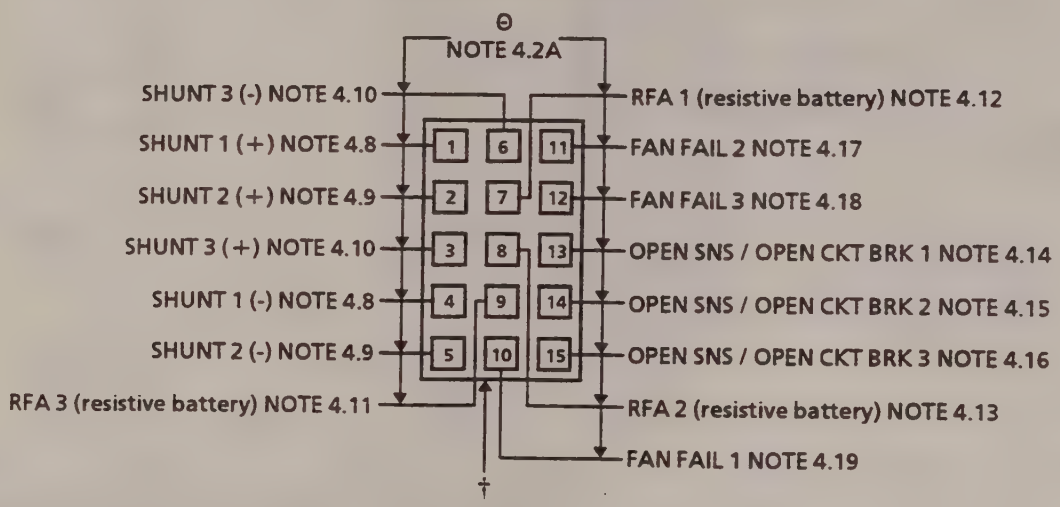


ACCESSORY ALARM AND CONTROL TERMINAL BLOCK

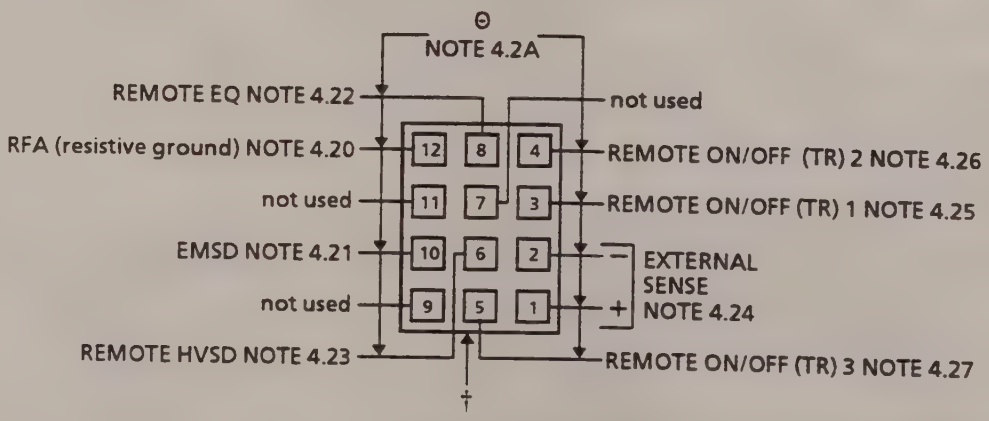
NOTE:
REFER TO CABINET INSTRUCTIONS FOR ACCESSORY INSTALLATION PROCEDURE

3. INSTALLER'S CONNECTIONS

J7
ALARM AND CONTROL



J8
ALARM AND CONTROL



4. INSTALLER'S INFORMATION NOTES

4.1

AC INPUT (TB1)					
Terminals			Input Voltage	Recm Wire Size (Note 4.5)	Branch Circuit Protection
Capacity	Type	Recm Torque			
8 Ga. Max.	10-32 Screw Terminal	20 In-Lbs	208/240	10 Ga.	25 Amps

4.2 A

ALARM AND CONTROL (J7 & J8)			
Terminals		Loop Length (Ft.) (Note 4.6)	Recm. Wire Size (Note 4.5)
Capacity	Type		
22-18 Ga.	Locking Type Plug	0 - 200	22 Ga.
		over 200	18-20 Ga.

4.2 B

ACCESSORY ALARM AND CONTROL TERMINAL BLOCK (TB2)				
Terminals			Loop Length (Ft.) (Note 4.6)	Recm. Wire Size (Note 4.5)
Capacity	Type	Recm Torque		
14 Ga. Max.	6-32 Screw	9 In-Lbs	0 - 200	22 Ga.
			over 200	18-20 Ga.

4.3

FRAME GROUND (Note 4.7)			
Terminal			Recm Wire Size (Note 4.5)
Capacity	Type	Recm Torque	
14-6 Ga.	Saddle Clamp	35 In-Lbs (14-10 Ga.) 40 In-Lbs (8 Ga.) 45 In-Lbs (6 Ga.)	10 Ga.

4. INSTALLER'S INFORMATION NOTES

4.4 DC Output: Drilled busbars are provided for installation of customer furnished DC output lugs. The tables below list the recommended crimp or screw type pressure lugs for various loop lengths. Recommended torque for lug mounting hardware is 180 inch-pounds.

SCREW TYPE COMPRESSION LUG				
Loop Length (Ft) (Note 4.6)	Recm Wire Size (Note 4.5)	Recommended Lug		Capacity
		Vendor(s)	Part No.	
75 94 119	2/0 3/0 4/0	Ilsco	F0975A00B W/E 37	1/0 to 350 kcmil
		Southland Industries	CO-300-406M	

CRIMP LUG							
Loop Length (Ft) (Note 4.6)	Recm Wire Size (Note 4.5)	Wire Stranding Class	Recommended Lug		*Crimp Tool Required T & B Model TBM12 OR TBM15 Hydraulic Heads		
			Vendor(s)	Part No.	Color Key	Die Index/ Code No.	Die Cat. Number
75	2/0	B	T & B	54210	Black	45	15526
			Burndy	YA26L-2TC38			
		I	T & B	54211	Orange	50	15530
			Burndy	YAV26L-2TC38-FX			
94	3/0	B	T & B	54211	Orange	50	15530
			Burndy	YA27L-2TC38			
		I	T & B	54212	Purple	54H	15511
			Burndy	YA28L-2TC38			
119	4/0	B	T & B	54212	Purple	54H	15511
			Burndy	YA28L-2TC38			
		I	T & B	256-30695-835	Yellow	62	15510
			Burndy	YAV-28L-2TC38-FX			

* The lugs should be crimped to the specifications given in the manufacturer's instructions furnished with the crimp tool or lug.

4.5 Wires sizes based on recommendations of the National Electrical Code Table 310-16 for copper wire at 75°C conductor temperature, operating in ambient of 30°C. For operation in ambient higher than 30°C, apply derating factors listed in Table 310-16 of the National Electrical Code.

4. INSTALLER'S INFORMATION NOTES

4.6 DC output wire size sufficient to restrict voltage drop to one volt or less at rated full load output current for the loop lengths shown. The loop length is the sum of the lengths of the positive and negative leads.

4.7 Connect this wire to earth ground. Equipment grounding conductor size based on recommendations of the National Electrical Code Table 250-95 for copper wire. If aluminum or copper clad aluminum grounding conductor is used refer to Table 250-95 for increased conductor size.

For relay rack grounding requirements, refer to the National Electrical Code, applicable local codes, and your specific site requirements.

4.8 **Shunt - Rectifier Module 1:** A signal that is proportional (1 millivolt = 1 ampere) to the output current of rectifier Module 1 (shunt output) is available at J7 pins 1 (+) and 4 (-) for use in an energy management system.

4.9 **Shunt - Rectifier Module 2:** A signal that is proportional (1 millivolt = 1 ampere) to the output current of rectifier Module 2 (shunt output) is available at J7 pins 2 (+) and 5 (-) for use in an energy management system.

4.10 **Shunt - Rectifier Module 3:** A signal that is proportional (1 millivolt = 1 ampere) to the output current of rectifier Module 3 (shunt output) is available at J7 pins 3 (+) and 6 (-) for use in an energy management system.

4.11 **Rectifier Fail Alarm (resistive battery) - Rectifier Module 3:** If the AC input circuit breaker of rectifier Module 3 is tripped open either manually or automatically, or if a failure disables rectifier Module 3, -BAT is supplied through a 6.81K ohm resistor to J7 pin 9. Under normal conditions, ground (+BAT) is supplied.

4.12 **Rectifier Fail Alarm (resistive battery) - Rectifier Module 1:** If the AC input circuit breaker of rectifier Module 1 is tripped open either manually or automatically, or if a failure disables rectifier Module 1, -BAT is supplied through a 6.81K ohm resistor to J7 pin 7. Under normal conditions, ground (+BAT) is supplied.

4.13 **Rectifier Fail Alarm (resistive battery) - Rectifier Module 2:** If the AC input circuit breaker of rectifier Module 2 is tripped open either manually or automatically, or if a failure disables rectifier Module 2, -BAT is supplied through a 6.81K ohm resistor to J7 pin 8. Under normal conditions, ground (+BAT) is supplied.

4.14 **Open Sense Lead/Open Output Circuit Breaker - Rectifier Module 1:** If an external sense lead opens or the DC OUTPUT circuit breaker of rectifier Module 1 opens either manually or automaticaly, ground (+BAT) is supplied to J7 pin 13.

4.15 **Open Sense Lead/Open Output Circuit Breaker - Rectifier Module 2:** If an external sense lead opens or the DC OUTPUT circuit breaker of rectifier Module 2 opens either manually or automaticaly, ground (+BAT) is supplied to J7 pin 14.

4.16 **Open Sense Lead/Open Output Circuit Breaker - Rectifier Module 3:** If an external sense lead opens or the DC OUTPUT circuit breaker of rectifier Module 3 opens either manually or automaticaly, ground (+BAT) is supplied to J7 pin 15.

4.17 **Fan Fail - Rectifier Module 2:** If the internal fan of rectifier Module 2 fails, ground (+BAT) is supplied to J7 pin 11.

4.18 **Fan Fail - Rectifier Module 3:** If the internal fan of rectifier Module 3 fails, ground (+BAT) is supplied to J7 pin 12.

4.19 **Fan Fail - Rectifier Module 1:** If the internal fan of rectifier Module 1 fails, ground (+BAT) is supplied to J7 pin 10.

4. INSTALLER'S INFORMATION NOTES

4.20 **Rectifier Fail Alarm (resistive ground):** If input circuit breaker of any rectifier module in the shelf is tripped open either manually or automatically, or if a failure disables any rectifier module, resistive ground or ground (+BAT) is supplied to J8 pin 12. Under normal conditions, resistive ground or ground is removed. Refer to Paragraph 1.4.6 for further information. If the accessory alarm and control terminal block is installed, the RFA signal is available at pin 1 of TB2.

4.21 **Emergency Shutdown:** Customer furnished ground (+BAT) applied to J8 pin 10 trips open the AC INPUT circuit breakers of all rectifier modules in the shelf.

4.22 **Remote Equalize:** Customer furnished ground (+BAT) applied to J8 pin 8 places all rectifier modules into equalize charge mode of operation. Removal of ground (+BAT) from this terminal places all rectifier modules into float charge mode of operation. If the accessory alarm and control terminal block is installed, the remote equalize signal (EQ) is connected to pin 5 of TB2.

4.23 **Remote High Voltage Shutdown:** Customer furnished ground (+BAT) applied to J8 pin 6 activates the selective high voltage shutdown circuit of all rectifier modules in the shelf. Refer to Paragraph 1.4.3 (C) for a description of the selective high voltage shutdown circuit. Due to the selective nature of the shutdown circuit, only rectifier modules delivering 3 amperes or more of current shut down.

NOTE: *The ground (+BAT) signal must be removed within 200 milliseconds.*

4.24 **External Sense:** For external voltage sensing, extend leads from J8 pins 1 (+) and 2 (-) to the battery or power board. Extended sense leads should be fused at 1-1/3 amperes. If the accessory alarm and control terminal block is installed, the remote voltage sensing leads are connected to pin 2 (SNS+) and pin 3 (SNS-) of TB2. If pins 1 and 2 of J8 (or pins 2 and 3 of TB2) are not connected, local and remote alarms are activated and the rectifier modules will automatically transfer to internal voltage sensing.

NOTE: *Remote voltage sensing lead connections should be made to the rectifier side of any battery protective or disconnect devices present.*

4.25 **Remote On/Off (TR) - Rectifier Module 1:** Customer furnished ground (+BAT) applied to J8 pin 3 disables the output of rectifier Module 1. Removal of the ground signal returns the module to normal operation.

4.26 **Remote On/Off (TR) - Rectifier Module 2:** Customer furnished ground (+BAT) applied to J8 pin 4 disables the output of rectifier Module 2. Removal of the ground signal returns the module to normal operation.

4.27 **Remote On/Off (TR) - Rectifier Module 3:** Customer furnished ground (+BAT) applied to J8 pin 5 disables the output of rectifier Module 3. Removal of the ground signal returns the module to normal operation.

4.28 **Remote On/Off (TR) - All Modules:** Customer furnished ground (+BAT) applied to pin 4 of TB2 disables the output of all rectifier modules. Removal of the ground signal returns all modules to normal operation.

4.29 ⊖ - indicates leads furnished and run by installer.

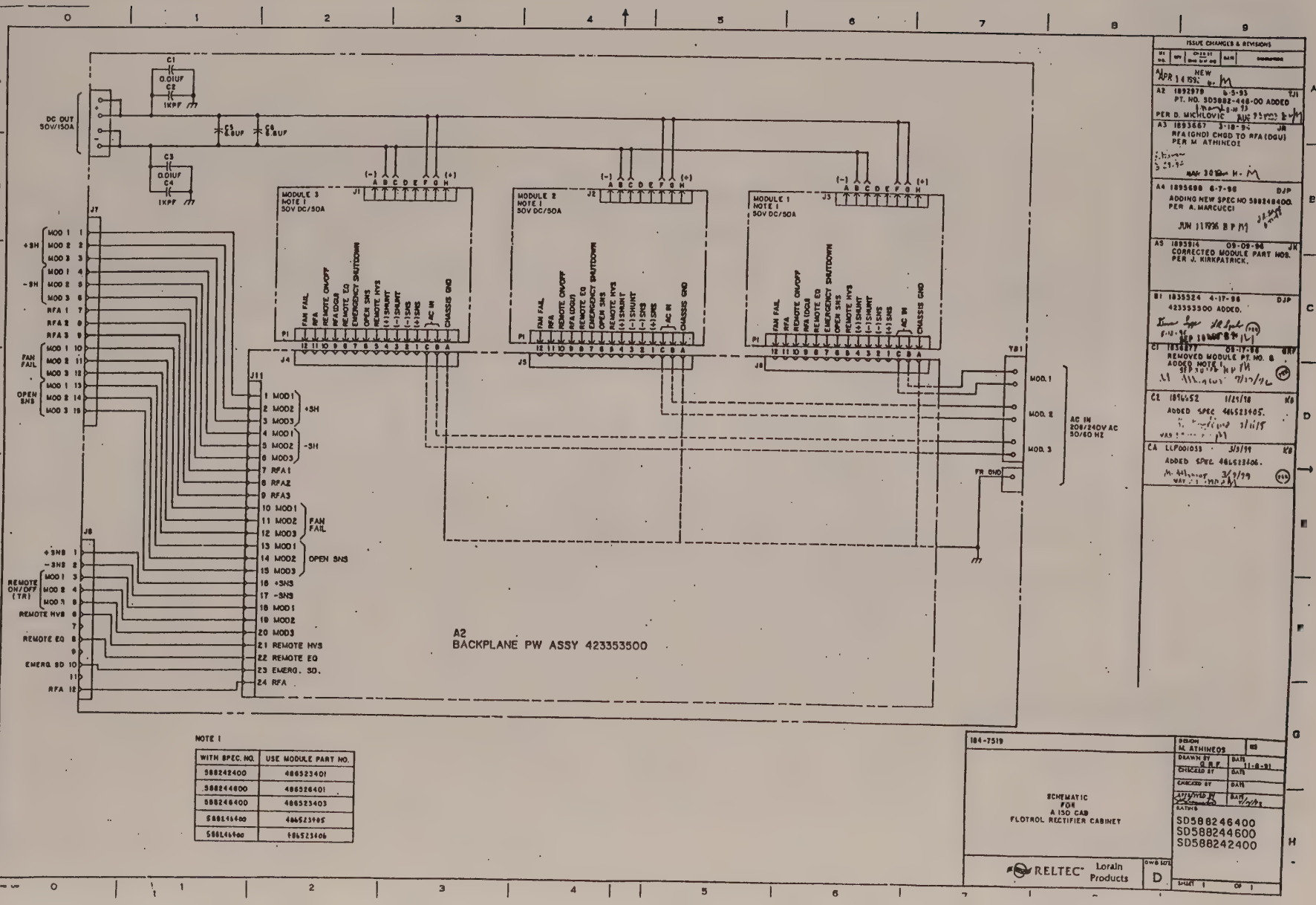
4.30 Δ - indicates leads furnished with the rectifier.

4.31 † - indicates mating connector to be furnished by the installer.

Mating Connector Part No. - AMP 172171-1 (P7), AMP 172170-1 (P8)

Mating Contact Part No. - AMP 170362-3

Hand Crimp Tool Required - AMP 724651-1



NOTE 1

WITH SPEC. NO.	USE MODULE PART NO.
588242400	486523401
588244600	486526401
588246400	486523403
588245600	486523405
588246600	486523406

ISSUE CHANGES & REVISIONS

A1	NEW APR 14 1994		
A2	1892979 6-3-93 TJH	PT. NO. 503082-446-00 ADDED PER D. MICHLOVIC	
A3	1893667 3-18-94 JR	RFA (GND) CHGD TO RFA (DGU) PER M ATHINEOS	
A4	1895608 6-7-96 DJP	ADDING NEW SPEC NO 588246400. PER A. MARCUCCI JUN 11 1996	
A5	1895814 09-09-96 JK	CORRECTED MODULE PART NOS. PER J. KIRKPATRICK.	
B1	1835524 4-17-96 DJP	423353300 ADDED. SEP 10 1997	
C1	1836277 08-17-98 GKF	REMOVED MODULE PT NO. 6 ADDED NOTE 1 SEP 30 1998	
C2	1836452 11/24/98 KB	ADDED SPEC 486523405.	
CA	LLP001033 3/3/99 KB	ADDED SPEC 486523406.	

184-7519

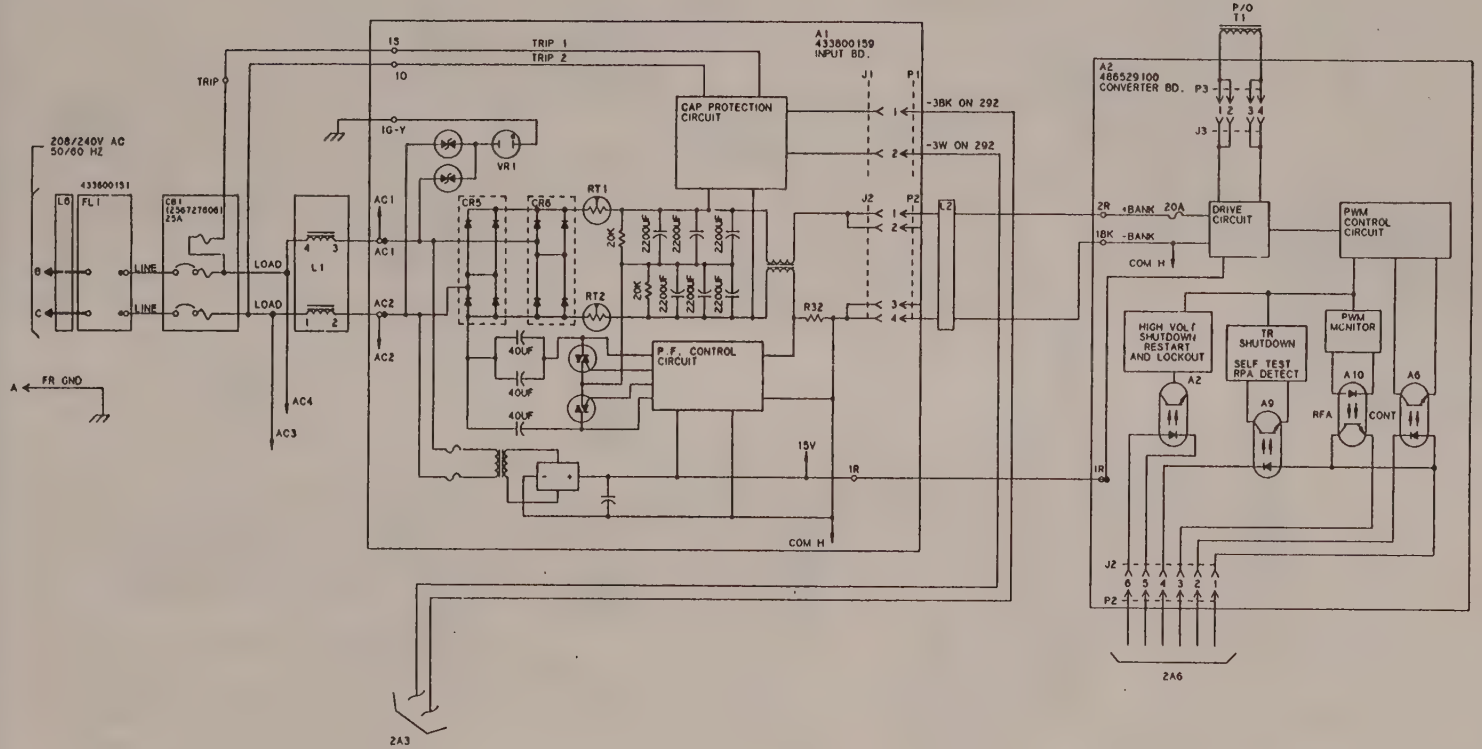
SCHEMATIC FOR A ISO CAB FLOTROL RECTIFIER CABINET

DESIGN	M. ATHINEOS
DRAWN BY	G.R.F. 11-8-91
CHECKED BY	
CHECKED BY	
APPROVED BY	
RATING	SD588246400 SD588244600 SD588242400

RELTEC Lorain Products

DWG SIZE D

SHEET 1 OF 1



REVISION RECORD			
REV	PRN NUMBER / DESCRIPTION	ATE CHANGED / APPROVALS	CHANGED BY
A1	NEW WAS 1815058 REV: 1B APR 19 1996 BP M		
A2	1895626 5-13-96 ADDITION OF SD486523402 AND SD486523403. PER M. ATHINEOS J. WAUGH 5/19/96 MAY 15 1996 BP M		LLC
B1	1837419 08-11-97 ADDED RESISTOR R500 AND CAPACITOR C500 JUN 6 1997 BP M M ATHINEOS 6/12/97		GRF
C1	1837013 2/7/97 REMOVED (SD486524B011). JUN 6 1997 BP M		KMB
D1	1837422 07-22-97 DELETED CAPACITOR C500 AND RESISTOR R500. J BLUM 7-23-97 JUL 24 1997 BP M		GRF
D2	1896652 01-07-98 ADDED SPEC 486523405. B.GOODLIVE 1/9/98 JAN 08 1998 BP M		GRF
DA	LLP001033 3/8/99 ADDED SPEC 486523406. MAY 4 1999 BP M. ATHINEOS 3/1/99		KMB

SD486523406

FIRST USED ON:

PROJECT NO. 1815058	COMPUTER GENERATED DRAWING		
		DRWN M ATHINEOS	DA
		CHK RICK HILL	12-1-95
		DSGN M. ATHINEOS	4-8-96
		ENGR	
		APPROVED D PETKOVSEK	4-8-96
		RATING STANDARD	

50 VOLT, 50 AMP MODULE FOR A150CAB

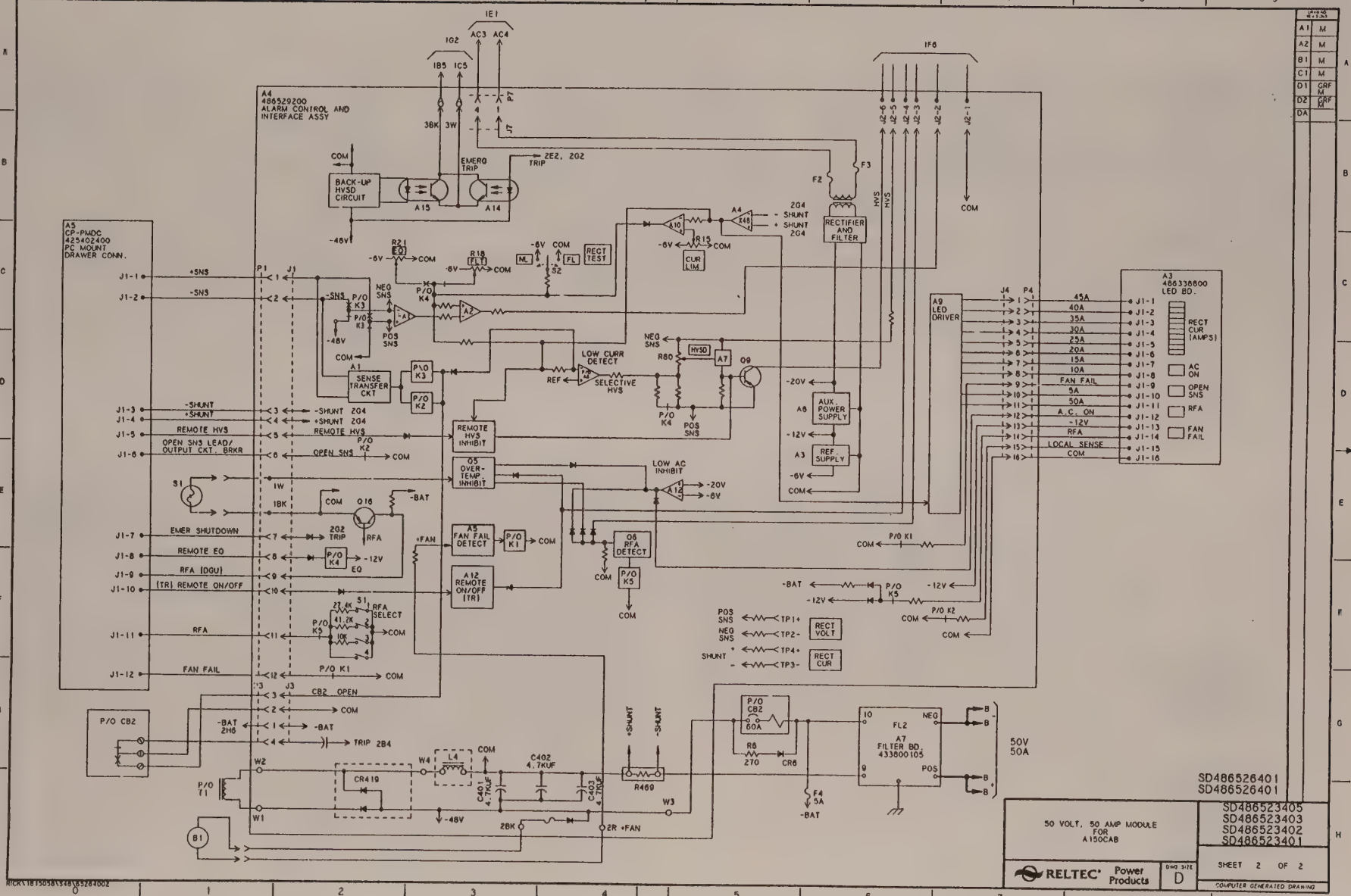
RELTEC Power Products

SIZE D

SD486526401
SD486523405
SD486523403
SD486523402
SD486523401

SHEET 1 OF 2

RICK\1815058\SD486523406


A4
486529200
ALARM CONTROL AND
INTERFACE ASSY
A5
CP-PMDC
425402400
PC MOUNT
DRAWER CONN.
BACK-UP
HVSD
CIRCUIT
EMERG
TRIP
2E2, 2G2
TRIP
RECTIFIER
AND
FILTER
SENSE
TRANSFER
CKT
LOW CURR
DETECT
SELECTIVE
HVS
REMOTE
HVS
INHIBIT
OS
OVER-
TEMP.
INHIBIT
LOW AC
INHIBIT
A9
FAN FAIL
DETECT
A12
REMOTE
ON/OFF
(TR)
Q6
RFA
DETECT
A9
LED
DRIVER
AUX.
POWER
SUPPLY
REF.
SUPPLY
A3
486338800
LED BD.
RECT
CUR.
(AMPS)
AC
ON
OPEN
SNS
RFA
FAN
FAIL
RECT
VOLT
RECT
CUR
RFA
SELECT
CB2 OPEN
TRIP 2B4
FAN FAIL
REMOTE ON/OFF
(TR)
REMOTE EQ
EMER SHUTDOWN
OPEN SNS LEAD/
OUTPUT CKT. BRKR
REMOTE HVS
-SHUNT
+SHUNT
+SNS
-SNS
FL2
A7
FILTER BD.
433800105
50V
50A
SD486526401
SD486526401
SD486523405
SD486523403
SD486523402
SD486523401
50 VOLT, 50 AMP MODULE
FOR
A150CAB
RELTEC Power Products
DWG SIZE
D
SHEET 2 OF 2
COMPUTER GENERATED DRAWING

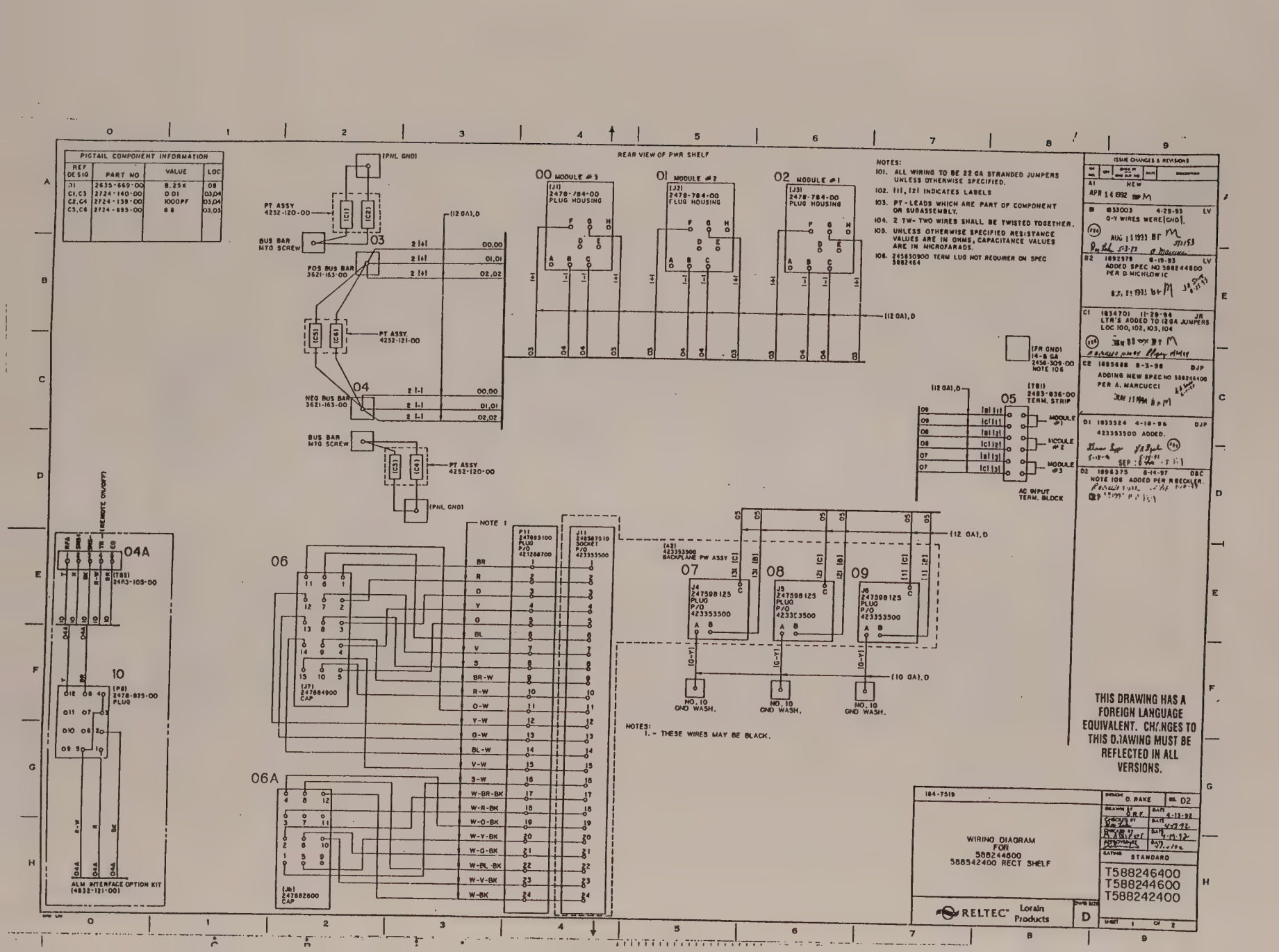
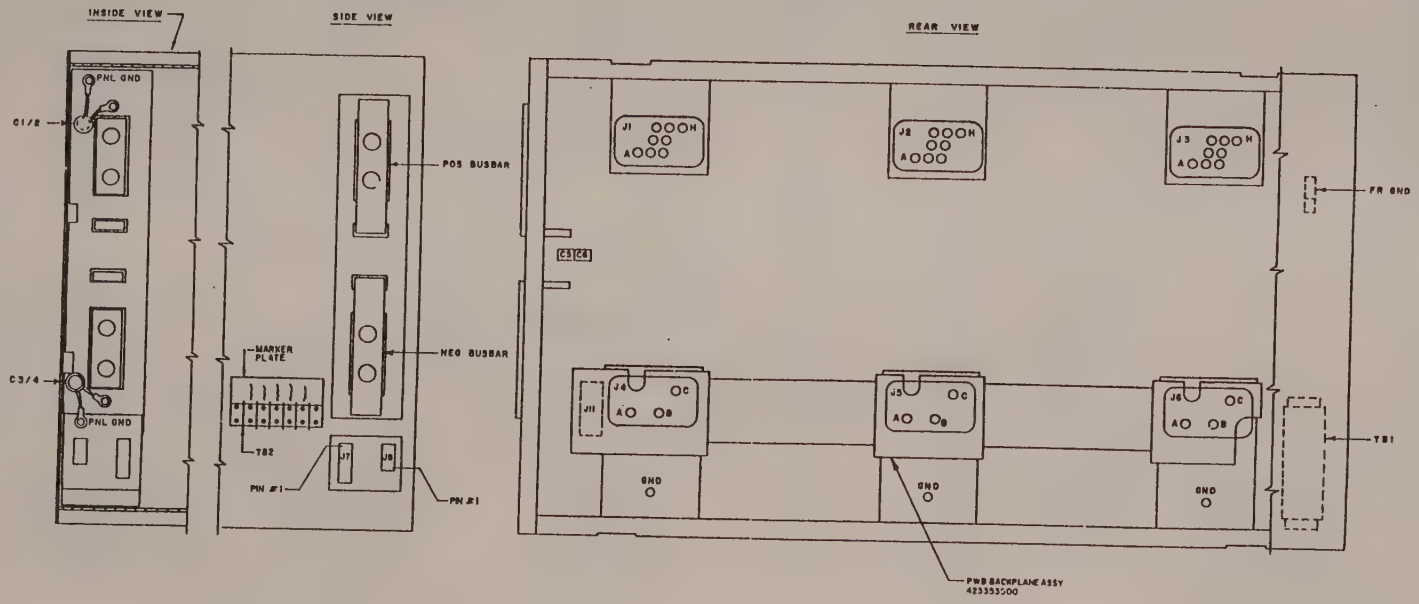
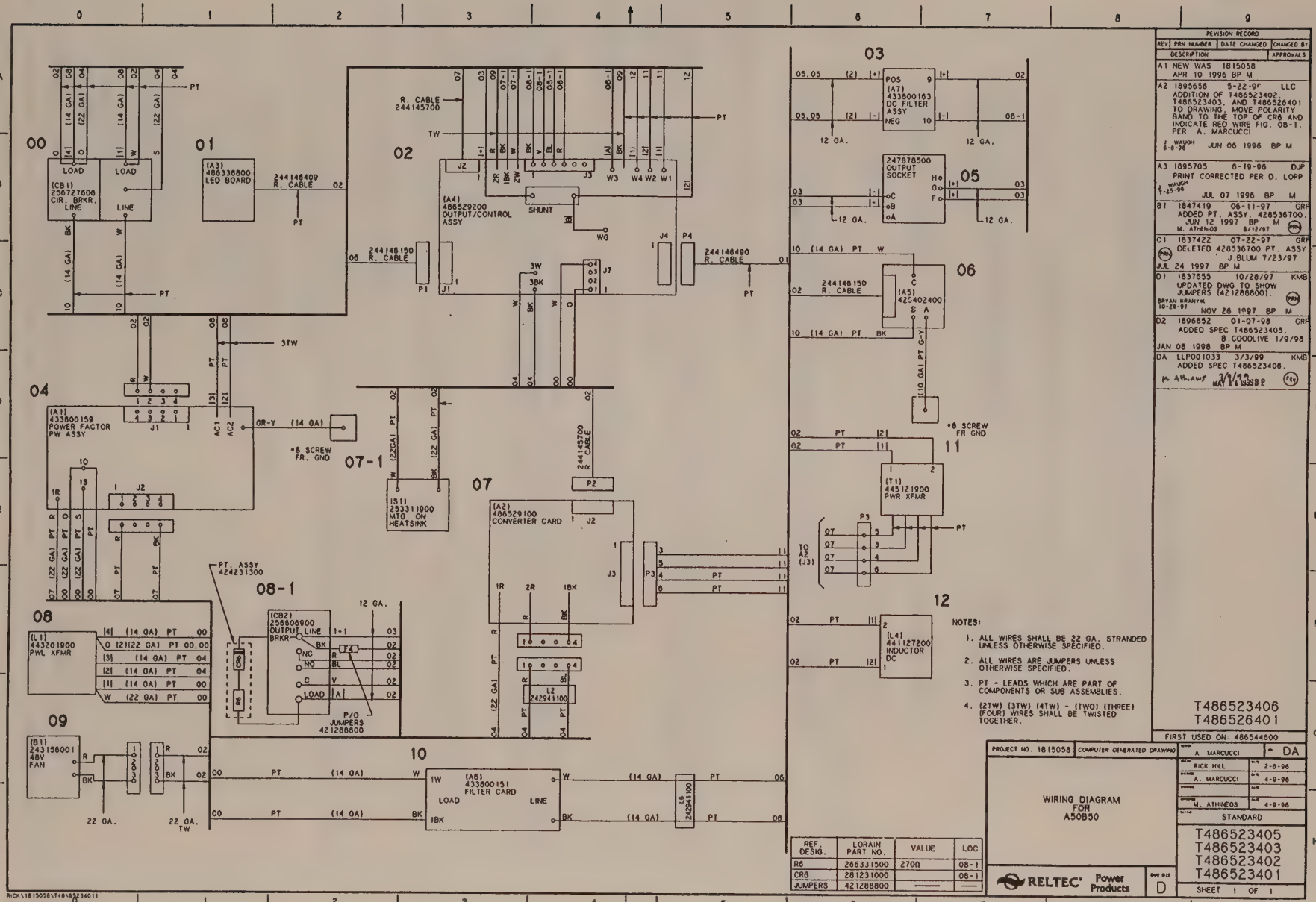

PIGTAIL COMPONENT INFORMATION
REF DESIG
PART NO
VALUE
LOC
C1
2635-669-00
8.25K
08
C1,C3
2724-140-001
0.01
03,04
C2,C4
2724-139-00
1000PF
03,04
C5,C6
2724-895-00
8.8
03,05
REAR VIEW OF PWR SHELF
(PNL GND)
PT ASSY 4252-120-00
BUS BAR MTG SCREW
POS BUS BAR 3621-163-00
NEG BUS BAR 3621-163-00
PT ASSY 4252-121-00
(12 GA),D
00 MODULE #3
01 MODULE #2
02 MODULE #1
(J1) 2478-784-00 PLUG HOUSING
(J2) 2478-784-00 PLUG HOUSING
(J3) 2478-784-00 PLUG HOUSING
NOTES:
101. ALL WIRING TO BE 22 GA STRANDED JUMPERS UNLESS OTHERWISE SPECIFIED.
102. (1), (2) INDICATES LABELS
103. PT - LEADS WHICH ARE PART OF COMPONENT OR SUBASSEMBLY.
104. 2 TW- TWO WIRES SHALL BE TWISTED TOGETHER.
105. UNLESS OTHERWISE SPECIFIED RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS.
106. 2458303900 TERM LUG NOT REQUIRED ON SPEC 588244
(FR GND) 14-8 GA 2458-309-00 NOTE 106
(TB1) 2483-036-00 TERM. STRIP
AC INPUT TERM. BLOCK
04A (TB2) 2483-103-00
10 (P8) 2478-825-00 PLUG
ALM INTERFACE OPTION KIT (4832-121-001)
NOTE 1
06 (J7) 247684900 CAP
06A (J8) 247682800 CAP
P11 247893100 PLUG P/O 421268700
J11 248587510 SOCKET P/O 423333500
BR
R
O
Y
G
BL
V
S
BR-W
R-W
O-W
Y-W
G-W
BL-W
V-W
S-W
W-BR-BK
W-R-BK
W-O-BK
W-Y-BK
W-G-BK
W-BL-BK
W-V-BK
W-BK
(A3) 423333500 BACKPLANE PW ASSY
07 J4 247598125 PLUG P/O 423333500
08 J5 247598125 PLUG P/O 423333500
09 J6 247598125 PLUG P/O 423333500
(10 GA),D
NO. 10 GND WASH.
NOTES:
1. - THESE WIRES MAY BE BLACK.
ISSUE CHANGES & REVISIONS
A1 NEW APR 14 1992
B 1833003 4-29-93 LV G-Y WIRES WERE (GND).
B2 1892979 8-19-93 LV ADDED SPEC NO 588244600 PER D MICHLOWICZ
C1 1834701 11-29-94 JR LTR'S ADDED TO 12GA JUMPERS LOC 100, 102, 103, 104
C2 1885688 8-3-96 DJP ADDING NEW SPEC NO 588246400 PER A. MARCUCCI
D1 1933324 4-10-96 DJP 423333500 ADDED.
D2 1896375 8-14-97 DBC NOTE 106 ADDED PER R BECKLER.
THIS DRAWING HAS A FOREIGN LANGUAGE EQUIVALENT. CHANGES TO THIS DRAWING MUST BE REFLECTED IN ALL VERSIONS.
184-7519
WIRING DIAGRAM FOR 588244600 588542400 RECT SHELF
DESIGN D. RAKE SIZE D2
DRAWN D.R.F. DATE 4-13-92
CHECKED DATE
APPROVED DATE
RATING STANDARD
T58824600
T58824600
T58242400
RELTEC Lorain Products
SHEET 1 OF 2

FIG 2
PARTS LOCATION



AISOCAB RECTIFIER SHELF	T588244600 T588242400
LORAIN PRODUCTS	DWG SIZE D
	SHEET 2 OF 2
	PRINTED IN U.S.A.
	SCALE D2



NOTES:

1. ALL WIRES SHALL BE 22 GA. STRANDED UNLESS OTHERWISE SPECIFIED.
2. ALL WIRES ARE JUMPERS UNLESS OTHERWISE SPECIFIED.
3. PT - LEADS WHICH ARE PART OF COMPONENTS OR SUB ASSEMBLIES.
4. (2TW) (3TW) (4TW) - (TWO) (THREE) (FOUR) WIRES SHALL BE TWISTED TOGETHER.

REF. DESIG.	LORAIN PART NO.	VALUE	LOC
R6	266331500	270Ω	08-1
CR6	281231000		08-1
JUMPERS	421286800	———	——

REVISION RECORD

REV	PRN NUMBER	DATE CHANGED	CHANGED BY
DESCRIPTION			APPROVALS

A1 NEW WAS 1815058 APR 10 1996 BP M

A2 1895658 5-22-96 LLC
ADDITION OF T486523402, T486523403, AND T486526401 TO DRAWING. MOVE POLARITY BAND TO THE TOP OF CR6 AND INDICATE RED WIRE FIG. 08-1. PER A. MARCUCCI
J. WALSH 6-6-96 JUN 06 1996 BP M

A3 1895705 6-19-96 DJP
PRINT CORRECTED PER D. LOPP
J. WALSH 7-25-96 JUL 07 1996 BP M

B1 1847419 06-11-97 GRF
ADDED PT. ASSY. 428536700.
JUN 12 1997 BP M
M. ATHINEOS 8/12/97 PRN

C1 1837422 07-22-97 GRF
DELETED 428536700 PT. ASSY
J.BLUM 7/23/97
JUL 24 1997 BP M

D1 1837655 10/28/97 KMB
UPDATED DWG TO SHOW JUMPERS (421286800).
BRYAN KRANTZ 10-28-97 PRN
NOV 26 1997 BP M

D2 1896852 01-07-98 GRF
ADDED SPEC T486523405.
B.GOODLIVE 1/9/98
JAN 08 1998 BP M

DA LLP001033 3/3/99 KMB
ADDED SPEC T486523406.
M. ATHINEOS 3/9/99 PRN

T486523406
T486526401

FIRST USED ON: 486544600

PROJECT NO. 1815058 | COMPUTER GENERATED DRAWING

DRAWN	A. MARCUCCI	DA
CHECKED	RICK HILL	2-6-96
ENGINEER	A. MARCUCCI	4-9-96
MFG	M. ATHINEOS	4-9-96
DATE	STANDARD	

WIRING DIAGRAM FOR A50B50

RELTEC Power Products

SIZE D

T486523405
T486523403
T486523402
T486523401

SHEET 1 OF 1

RICK\1815058\T486523401

FOR PARTS, SERVICE, DEPOT REPAIR, TECHNICAL ASSISTANCE OR TRAINING CALL TOLL FREE:

TECHNICAL ASSISTANCE/FIELD SERVICE . . . 800-800-5260

PARTS (CUSTOMER SERVICE) 800-927-2780
PARTS FAX 800-927-2781

DEPOT REPAIR 800-978-8810

TRAINING 800-398-8867

RELTEC SERVICES OFFERS 24-HOUR ASSISTANCE!

MONDAY-FRIDAY 8 A.M. to 8 P.M. EST

THE RELTEC SERVICES HELP DESK is staffed five days a week from 8 A.M. to 8 P.M. EST. If you have a question or concern with any RELTEC power equipment, call the Help Desk at **800-800-5260** to speak with a qualified Technical Support representative.

MONDAY-FRIDAY 8 P.M. to 8 A.M. EST, WEEKENDS and HOLIDAYS

EMERGENCY ASSISTANCE is also available from RELTEC Services outside of normal business hours. In the event of a "Site Down (off air) or on Battery Backup" situation caused by failure of a RELTEC power system or a component thereof, calls to the Help Desk at **800-800-5260** will be returned within minutes by a Technical Support Representative.

NON EMERGENCY: If the situation is not an emergency as defined above, the calling party is asked to please call the Help Desk on the next business day.

WHEN CALLING THE HELP DESK...

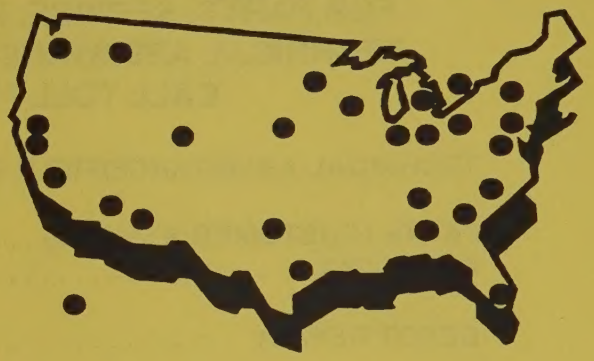
When making a call to the Help Desk, the calling party should identify themselves and their company, and be prepared to provide the following information:

1. Equipment Model Number (for example, V100B25)
2. Equipment Specification Number (Spec. No.)
3. Equipment Serial Number
4. Site Address
5. Site Contact Name
6. Site Contact Phone Number
7. Fax Number
8. Ship-to Address

This information is required for any repair and/or service to be performed by RELTEC Services.

RELTEC Services

Your Single Source Service Provider



FIELD SUPPORT LOCATIONS

For Field Service and Support 800-800-5260

ALABAMA
Mobile

ARIZONA
Mesa, Glendale

CALIFORNIA
Long Beach, Fremont, Calistoga

COLORADO
Thornton

CONNECTICUT
S. Windsor

FLORIDA
Miami

GEORGIA
Suwanee

ILLINOIS
Fairfield, Palantine

INDIANA
Indianapolis

MICHIGAN
Tecumseh

MINNESOTA
Carver

MISSOURI
Independence

MONTANA
Billings

NEW YORK
Utica

OHIO
North Ridgeville

PENNSYLVANIA
Corsica, Philadelphia

TEXAS
Spring, Euless

VIRGINIA
Virginia Beach

WASHINGTON
Kent

WISCONSIN
De Forest

CANADA
122 Edward Street
St. Thomas, Ontario, Canada
N5P1Z2
Telephone: 519/631-0780
Fax: 519-631-0359

MEXICO
S.A. de C.V.
Apartado Postal 77001
Mexico, 10 D.F. MX 11200
Telephone: (5) 576-8277
Fax: (525) 358-7195

UNITED KINGDOM
Unit D8, West Entrance
Fairoaks Airport
Chobham, Woking

RELTEC SERVICES CAN ALSO PROVIDE:

- FIELD SERVICE
- PARTS KITS AND FUSE KITS
- DEPOT REPAIR
- MAINTENANCE CONTRACTS
  - Power Equipment
  - Software/Hardware
- POWER EVALUATION PROGRAM (PEP)
  - Power Analysis For The Entire Power Room
- POWERTHERM THERMOGRAPHIC SURVEY
  - Infrared Scanning For Your Power Room
- FULL ENGINEER, FURNISH AND INSTALL (EF&I) SERVICES
- TRAINING
  - Factory
  - Customer Site
- TEST AND TURNUP
- SPECIALIZED TEST EQUIPMENT
  - Battery Impedance/resistance Testing
  - Load Simulators - AC & DC
- UPGRADES AND REFURBISHMENTS
- SPARE FUSE HOLDER

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In Canada	
RELTEC CANADA	519-645-9440